NAVSHIPS 92147 (A)

INSTRUCTION BOOK

for

RADIO INTERFERENCE MEASURING SET AN/URM-47

STODDART AIRCRAFT RADIO CO., INC.
HOLLYWOOD 38, CALIFORNIA

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

Ser # 213.

NAVSHIPS 92147(A) *(Non-Registered)*

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A to C	Original	5–1 to 5–4	Original
i to iii	Original	6–1	Original
1–0 to 1–8	Original	7–1 to 7–38	Original
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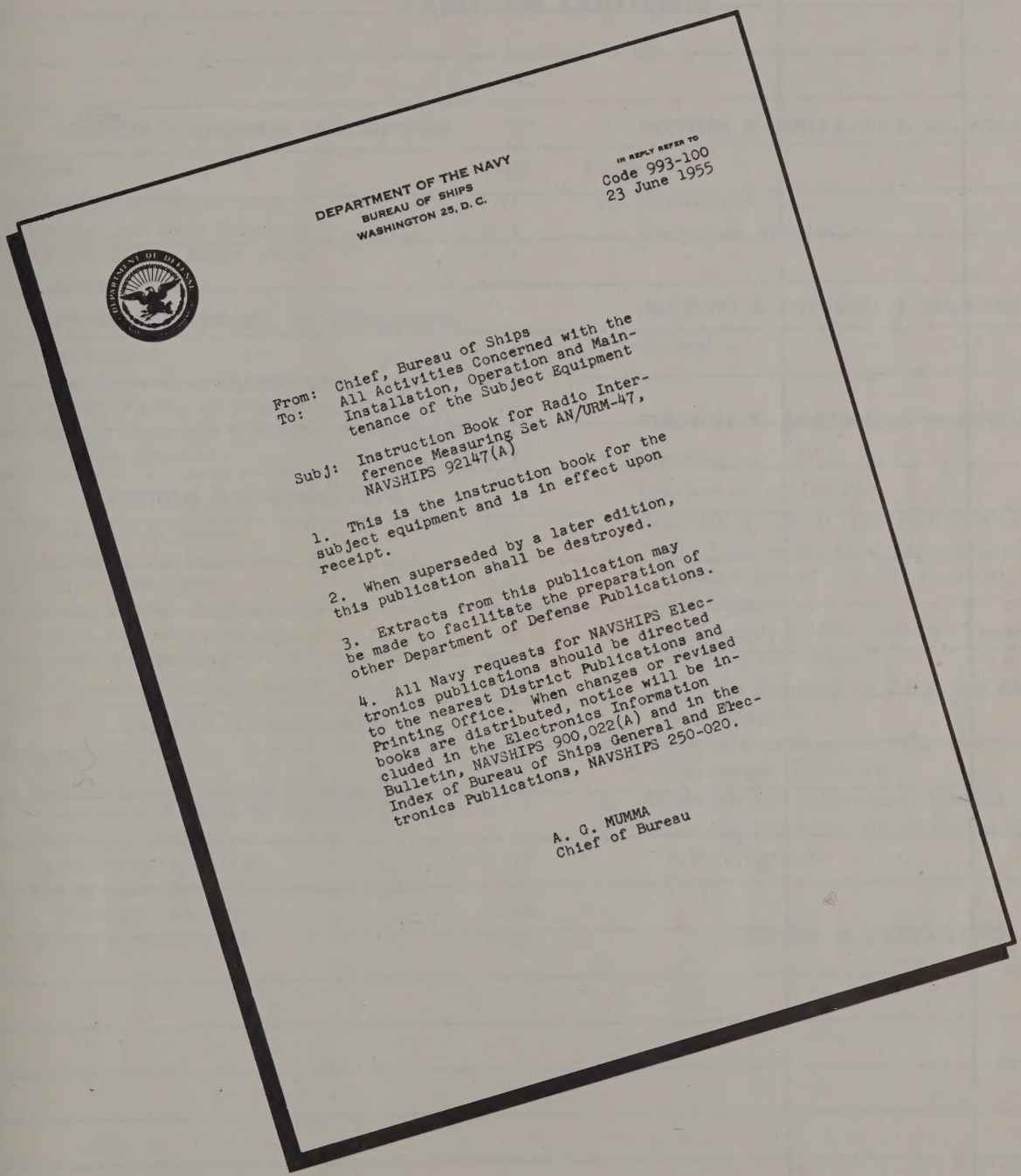

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
23 June 1955

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Radio Interference Measuring Set AN/URM-47, NAVSHIPS 92147(A)

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

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A. G. MUMMA
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

TABLE OF CONTENTS

SECTION 1—GENERAL DESCRIPTION

Paragraph *Page*

1. Scope of Instruction Book ..... 1—1
2. Purpose and Basic Principles ..... 1—1
3. Description of Major Units ..... 1—1
4. Reference Data ..... 1—6

SECTION 2—THEORY OF OPERATION

1. Introduction ..... 2—1
2. General Theory of Operation ..... 2—2
3. Detailed Theory of Operation, RI-FI Meter 2—6
4. Detailed Theory of Operation, Power Supply PP-906/URM-47 ..... 2—23

SECTION 3—INSTALLATION

1. Scope of This Section ..... 3—1
2. Unpacking the Equipment ..... 3—1
3. Dimensional Data ..... 3—1
4. Power Supply Requirements ..... 3—2
5. Initial Equipment Set-Up ..... 3—2
6. Initial Adjustments ..... 3—7
7. Transporting the Equipment ..... 3—9

SECTION 4—OPERATION

1. Introduction ..... 4—0
2. Equipment Controls and Receptacles ..... 4—1
3. Description of Chart Set PT-188/URM-47 .. 4—1
4. Operating Instructions ..... 4—6
5. Summary of Operation ..... 4—18
6. Use as a Sensitive Two-Terminal Radio Frequency Voltmeter ..... 4—20
7. Survey Considerations ..... 4—20

SECTION 5—OPERATOR'S MAINTENANCE

Paragraph *Page*

1. Introduction ..... 5—1
2. Emergency Maintenance ..... 5—1

SECTION 6—PREVENTIVE MAINTENANCE

1. General ..... 6—1

SECTION 7—CORRECTIVE MAINTENANCE

1. Introduction ..... 7—1
2. Localization of Trouble ..... 7—2
3. Removal of Chassis from Instrument Case .. 7—4
4. Radio Interference-Field Intensity Meter IM-88/URM-47 Trouble Shooting and Repair ..... 7—4
5. Power Supply PP-906/URM-47 Trouble Shooting and Repair ..... 7—13
6. Equipment Required for Alignment and Adjustment ..... 7—14
7. Set-Up of Equipment for Alignment and Adjustment Procedures ..... 7—14
8. Alignment and Adjustment Procedures ..... 7—14
9. Correcting Chart Set PT-188/URM-47 After Alignment ..... 7—19

SECTION 8—PARTS LISTS

LIST OF ILLUSTRATIONS

SECTION 1—GENERAL DESCRIPTION

Figure	Title	Page
1–1	Radio Interference Measuring Set AN/URM-47, Relationship of Units	1–0
1–2	Test Set Case CY-1527/URM-47, Contents Displayed	1–2
1–3	Radio Interference-Field Intensity Meter IM-88/URM-47 (RI-FI Meter)	1–2
1–4	Accessories Case CY-1525/URM-47, Contents Displayed	1–3
1–5	Power Supply PP-906/URM-47	1–4
1–6	Antenna Case CY-1526/URM-47, Contents Displayed	1–5

SECTION 2—THEORY OF OPERATION

2–1	Radio Interference Measuring Set AN/URM-47, Overall Block Diagram	2–3
2–2	Radio Interference Measuring Set AN/URM-47, Simplified Block Diagram	2–5
2–3	R-f Attenuator and Input Stages, Simplified Schematic Diagram	2–6
2–4	Input Filter Stage, Simplified Schematic Diagram	2–7
2–5	R-f Stages, Block Diagram	2–8
2–6	R-f Amplifier Stage, Simplified Schematic Diagram	2–8
2–7	Local Oscillator Stage, Simplified Schematic Diagram	2–9
2–8	Mixer Stage, Simplified Schematic Diagram	2–9
2–9	Voltage Regulator Stage, Simplified Schematic Diagram	2–10
2–10	I-f Amplifier and Detector Stages, Block Diagram	2–10
2–11	Input and First I-f Amplifier Stage, Simplified Schematic Diagram	2–11
2–12	Second and Third I-f Amplifier Stages, Simplified Schematic Diagram	2–12
2–13	Fourth and Fifth I-f Amplifier Stages, Simplified Schematic Diagram	2–13
2–14	Detector Stage, Simplified Schematic Diagram	2–13
2–15	BFO (Beat Frequency Oscillator) Stage, Simplified Schematic Diagram	2–14
2–16	Impulse Generator and Calibrator Stage, Simplified Schematic Diagram	2–15
2–17	Pulse Amplifier and Visual Null Indicator Stages, Simplified Schematic Diagram	2–16
2–18	VTVM and Indicating Meter Stage, Simplified Schematic Diagram	2–16
2–19	Video and Audio Amplifier Stages, Simplified Schematic Diagram	2–17
2–20	Function Switch S102, Simplified Schematic Diagram	2–18
2–21	Function Switch in FIELD INTENSITY Position, Simplified Circuits	2–19

SECTION 2—THEORY OF OPERATION (Cont'd)

2–22	Function Switch in QUASI PEAK Position, Simplified Circuits	2–20
2–23	Function Switch in PEAK Position, Simplified Circuits	2–21
2–24	Function Switch in BFO Position, Simplified Circuits	2–22
2–25	Function Switch in CAL Position, Simplified Circuits	2–23
2–26	Power Supply PP-906/URM-47, Complete Schematic Diagram	2–24

SECTION 3—INSTALLATION

3–1	Radio Interference Measuring Set AN/URM-47, Unpacking Procedure	3–1
3–2	Radio Interference-Field Intensity Meter IM-88/URM-47, Outline Drawing	3–2
3–3	Power Supply PP-906/URM-47, Outline Drawing	3–2
3–4	Carrying Cases, Outline Drawing	3–3
3–5	Dipole Antennas and Tripod, Outline Drawing	3–4
3–6	Radio Interference Measuring Set AN/URM-47, Connection Diagram	3–5
3–7	Method of Indexing Azimuth Dial on Tripod	3–8
3–8	Azimuth Dial and Azimuth Pointer Assemblies Mounted on Tripod	3–8
3–9	Method of Checking Azimuth Pointer Assembly for Angular Position	3–9

SECTION 4—OPERATION

4–1	Radio Interference-Field Intensity Meter IM-88/URM-47, Panel Controls and Receptacles	4–0
4–2	Power Supply PP-906/URM-47, Panel Controls and Receptacles	4–1
4–3	Calibration Settings, Bands 1 through 6 (Charts Nos. 1 and 2)	4–3
4–4	Antenna Adjustments Data (Chart No. 3)	4–4
4–5	Correction Factors (Charts Nos. 4 and 5)	4–5
4–6	Bandwidth Data, Bands 1 through 6 (Charts Nos. 6 and 7)	4–6
4–7	Correction Chart for Sine Wave Signals in the Presence of High Ambient Interference of Random Nature	4–6
4–8	Impulsive Interference Signal Correction Factors and Square Root Scale for Bandwidth (Chart No. 9)	4–7
4–9	Adjustment of Mast AB-371/U (High-frequency Dipole)	4–8
4–10	Adjustment of Antenna AT-477/U (Low-frequency Dipole)	4–10
4–11	Adjustment of Antenna Base AB-364/U (Ground Plane Vertical Antenna)	4–10

LIST OF ILLUSTRATIONS (Cont'd)

SECTION 4—OPERATION (Cont'd)

Figure	Title	Page
4–12	Directional Characteristics of Antenna AT-426/U (Loop Antenna)	4–11
4–13	Radio Interference-Field Intensity Meter IM-88/URM-47, Simplified Operating Procedure	4–12
4–14	Conversion Chart for Decibels Above One Microvolt vs. Microvolts Output	4–14

SECTION 5—OPERATOR'S MAINTENANCE

5–1	Radio Interference-Field Intensity Meter IM-88/URM-47, Tube Locations	5–2
5–2	Power Supply PP-906/URM-47, Tube Locations	5–3
5–3	Miniature Tube Pin Straightener	5–3
5–4	Removal of Subminiature Tubes	5–3
5–5	Radio Interference-Field Intensity Meter IM-88/URM-47, Location of Accessory Tools	5–4

SECTION 7—CORRECTIVE MAINTENANCE

7–1	Failure Report	7–2
7–2	Radio Interference-Field Intensity Meter IM-88/URM-47, Trouble Shooting Chart	7–3
7–3	Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Bottom View (Case Removed)	7–5
7–4	Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Rear View (I-f Chassis)	7–5
7–5	Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Sheet 1 of 2 Sheets)	7–6
7–5	Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Sheet 2 of 2 Sheets)	7–7

SECTION 7—CORRECTIVE MAINTENANCE (Cont'd)

Figure	Title	Page
7–6	Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Showing Compartments) (Sheet 1 of 2 Sheets)	7–8
7–6	Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Showing Compartments) (Sheet 2 of 2 Sheets)	7–9
7–7	Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Rear View (I-f Chassis Removed)	7–10
7–8	Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Bottom View (I-f Chassis Removed)	7–11
7–9	Power Supply PP-906/URM-47, Chassis Top View	7–12
7–10	Power Supply PP-906/URM-47, Chassis Bottom View	7–13
7–11	Radio Interference Measuring Set AN/URM-47, Voltage and Resistance Data	7–29
7–12	Radio Interference-Field Intensity Meter IM-88/URM-47, Wiring Diagram	7–31
7–13	Power Supply PP-906/URM-47, Wiring Diagram	7–33
7–14	Radio Interference Measuring Set AN/URM-47, Complete Schematic Diagram (Sheet 1 of 2 Sheets)	7–35
7–14	Radio Interference Measuring Set AM/URM-47, Complete Schematic Diagram (Sheet 2 of 2 Sheets)	7–37

LIST OF TABLES

SECTION 1—GENERAL DESCRIPTION

Table	Title	Page
1–1	Equipment Supplied	1–7
1–2	Shipping Data	1–8
1–3	Electron Tube Complement	1–8

SECTION 4—OPERATION

4–1	Designation and Function of Panel Controls and Receptacles	4–2
4–2	Frequency vs. Antenna Element Length	4–9
4–3	Field Intensity Data Record Sheet	4–23
4–4	Radio Interference Data Sheet	4–24
4–5	Radio Interference Data Sheet	4–25

SECTION 7—CORRECTIVE MAINTENANCE

7–1	Accessory Test Equipment	7–2

SECTION 7—CORRECTIVE MAINTENANCE (Cont'd)

Table	Title	Page
7–2	R-f Alignment Chart (Bands 1 through 6)	7–17
7–3	Electron Tube Operating Voltages	7–21
7–4	Winding Data	7–22

SECTION 8—PARTS LISTS

8–1	List of Major Units	8–1
8–2	Table of Replaceable Parts	8–2
8–3	Maintenance Parts Kit	8–47
8–4	Cross Reference Parts List	8–48
8–5	Applicable Color Codes and Miscellaneous Data	8–51
8–6	List of Manufacturers	8–52

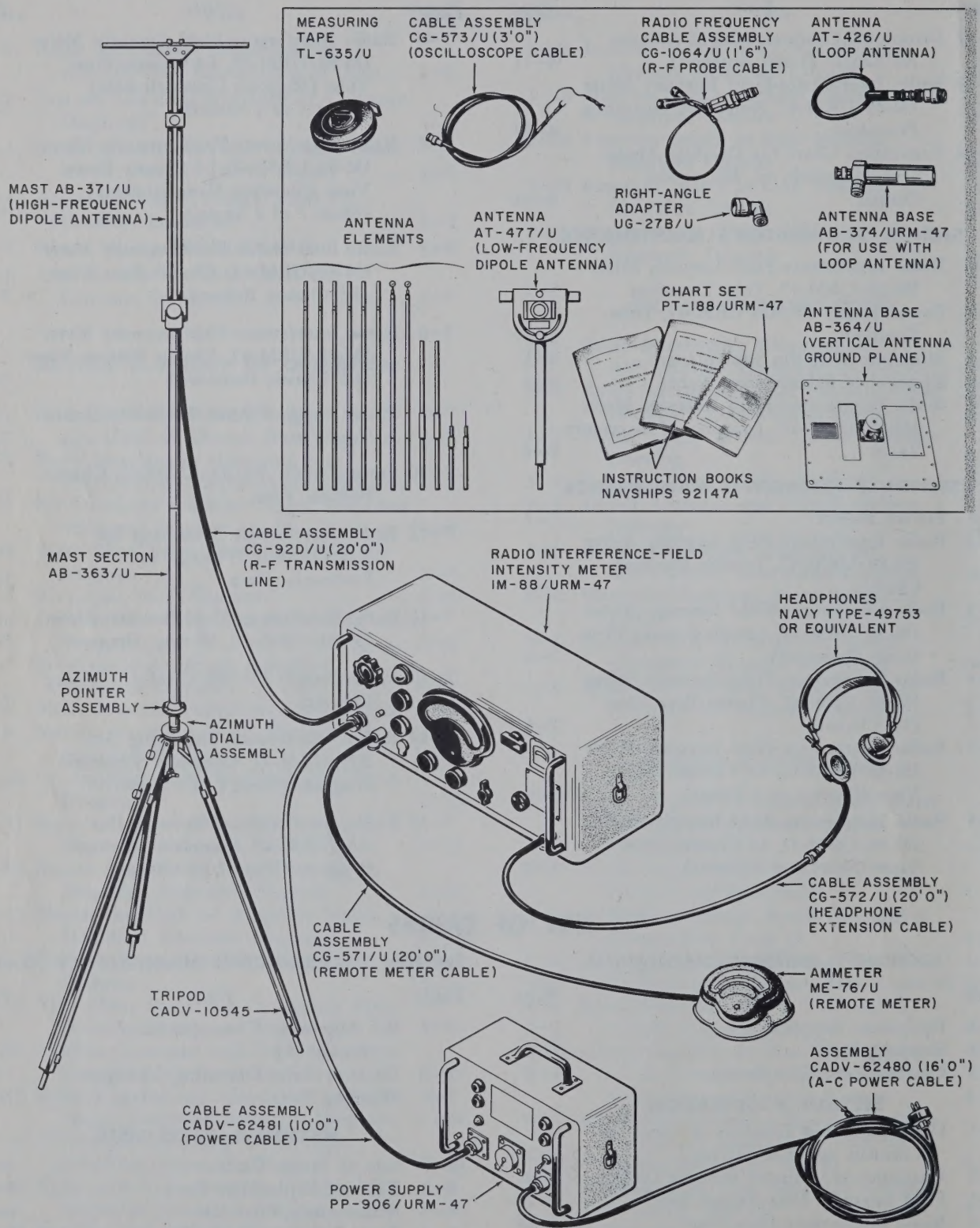
MEASURING TAPE TL-635/U
CABLE ASSEMBLY CG-573/U (3'0") (OSCILLOSCOPE CABLE)
RADIO FREQUENCY CABLE ASSEMBLY CG-1064/U (1'6") (R-F PROBE CABLE)
ANTENNA AT-426/U (LOOP ANTENNA)
ANTENNA BASE AB-374/URM-47 (FOR USE WITH LOOP ANTENNA)
RIGHT-ANGLE ADAPTER UG-27B/U
MAST AB-371/U (HIGH-FREQUENCY DIPOLE ANTENNA)
ANTENNA ELEMENTS
ANTENNA AT-477/U (LOW-FREQUENCY DIPOLE ANTENNA)
CHART SET PT-188/URM-47
ANTENNA BASE AB-364/U (VERTICAL ANTENNA GROUND PLANE)
INSTRUCTION BOOKS NAVSHIPS 92147A
CABLE ASSEMBLY CG-92D/U (20'0") (R-F TRANSMISSION LINE)
MAST SECTION AB-363/U
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47
HEADPHONES NAVY TYPE-49753 OR EQUIVALENT
AZIMUTH POINTER ASSEMBLY
AZIMUTH DIAL ASSEMBLY
CABLE ASSEMBLY CG-572/U (20'0") (HEADPHONE EXTENSION CABLE)
CABLE ASSEMBLY CG-571/U (20'0") (REMOTE METER CABLE)
AMMETER ME-76/U (REMOTE METER)
TRIPOD CADV-10545
ASSEMBLY CADV-62480 (16'0") (A-C POWER CABLE)
CABLE ASSEMBLY CADV-62481 (10'0") (POWER CABLE)
POWER SUPPLY PP-906/URM-47

Figure 1–1. Radio Interference Measuring Set AN/URM-47, Relationship of Units

SECTION 1

GENERAL DESCRIPTION

1. SCOPE OF INSTRUCTION BOOK.

This instruction book contains descriptive material, theory of operation and instructions for the installation, operation and maintenance of Radio Interference Measuring Set AN/URM-47, manufactured under contract NObsr-64089, dated 15 December 1953, and will apply to equipments serial No. 1 to No. 272 procured under contract NObsr-52301, after they have been modified by Field Change 1—AN/URM-47. This Field Change included the installation of shield grounds to improve shielding effectiveness of the equipment, a circuit change to effect more reliable impulsive interference measurements and data to permit the measurement of impulsive interference signals directly in terms of microvolts-per-kilocycle without involving bandwidth computations.

2. PURPOSE AND BASIC PRINCIPLES.

(See figure 1—1.)

Radio Interference Measuring Set AN/URM-47 is a highly sensitive h-f and v-h-f superheterodyne receiver for use in the location and measurement of r-f interference (noise) and for making field-intensity measurements in the frequency range of 20 to 400 mc. It is basically a selective two-terminal voltmeter with sufficient sensitivity to measure r-f interference or the intensity of radiated or conducted r-f signals.

Note

Radio Interference-Field Intensity Meter IM-88/URM-47 is the control and metering unit of Radio Interference Measuring Set AN/URM-47. For simplicity, the former will hereafter be referred to as the RI-FI Meter.

Radio Interference Measuring Set AN/URM-47 consists of the meter unit (RI-FI Meter), a power supply (Power Supply PP-906/URM-47), and several antennas for interference or signal pick-up, and other accessory components necessary for proper interconnection and operation of the equipment. The equipment is suitable for operation aboard naval vessels, at shore stations, in the field, in aircraft, and in military vehicles.

Quantitative measurements of the intensity of radio signals or interference can be made by use of the dipole antennas provided in conjunction with the RI-FI Meter. Measurements can be made in terms of the *peak*, *weighted*, or *average* value of the signal or interference. This facility is provided by a calibrated meter and a function switch on the meter unit. The function switch provides for the measurement of the peak value in its PEAK position, the weighted value in its QUASI PEAK position, and the average value in its FIELD INTENSITY position. In addition, the RI-FI Meter contains facilities for calibrating or standardizing its gain; this is accomplished in the CAL position of the function switch. To facilitate more accurate tuning of a weak signal, a beat frequency oscillator is incorporated in the i-f channel; by this means, the weak signal can be tuned by observing the zero beat note (audio null); then the strength of the signal can be measured accurately in either the FIELD INTENSITY or QUASI PEAK positions of the function switch.

Frequency-modulated signals can be received with reasonable audio quality through the use of "slope detection". This not only simplifies the circuitry of the receiver and minimizes maintenance parts, but also provides fair frequency-modulation quality without the use of complicated circuits and additional adjustments.

Radio Interference Measuring Set AN/URM-47 can be used for radio interference surveys to determine the source and magnitude of radiated or conducted interference within its frequency range. Such interference may be generated by gasoline engines, generators, motors, or electronic equipment. This equipment can be used for field intensity measurement surveys, for adjusting directive antennas, or for exploring radiation patterns, where the field intensity may vary over a wide range of values.

Proper use of the pick-up devices will enable the operator of the equipment to locate the source of the signal or interference by successive measurements. In the case of interference, this is the first step in the elimination procedures.

3. DESCRIPTION OF MAJOR UNITS.

a. CARRYING CASES.—Radio Interference Measuring Set AN/URM-47 is contained in three carrying cases for convenience in transporting the equipment. These cases, Test Set Case CY-1527/URM-47, Accessories Case CY-1525/URM-47, and Antenna Case CY-1526/URM-47 are similarly constructed of plywood with black fiber covering. Corners are protected with nickel plated brass plates. Each case has a flock-lined interior and is equipped with a carrying handle. The case interiors are

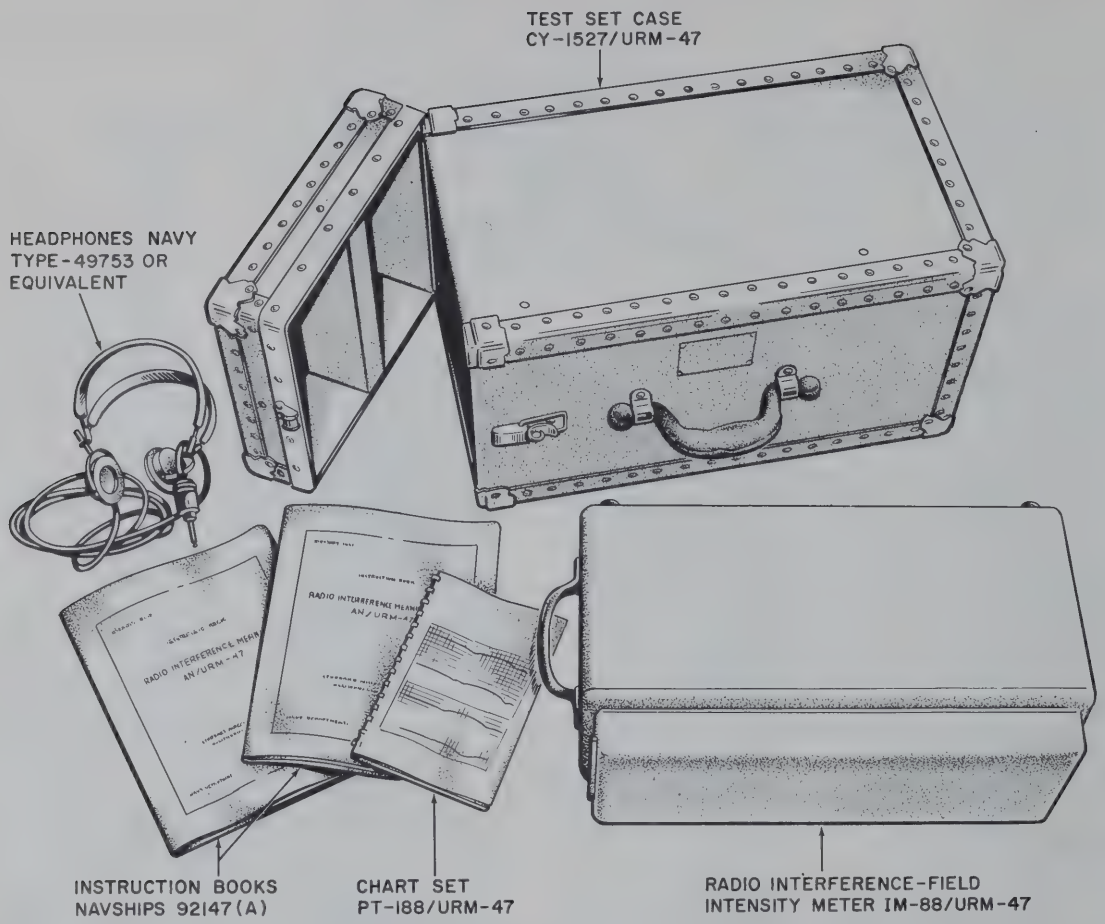

Figure 1–2. Test Set Case CY-1527/URM-47, Contents Displayed

fitted with racks, blocks, pads, or straps to hold the various units and accessories in position.

The succeeding subparagraphs describe the contents of the carrying cases and indicate the significant features of each.

Note

The interior of each carrying case contains a plate displaying the equipment which should be packed in the individual carrying case. To prevent loss of equipment, personnel responsible for repacking the equipment should place a check mark in the box following the name of each item as it is packed in the case. (See figures 1–2, 1–4, and 1–6.)

Figure 1–3. Radio Interference-Field Intensity Meter IM-88/URM-47 (RI-FI Meter)

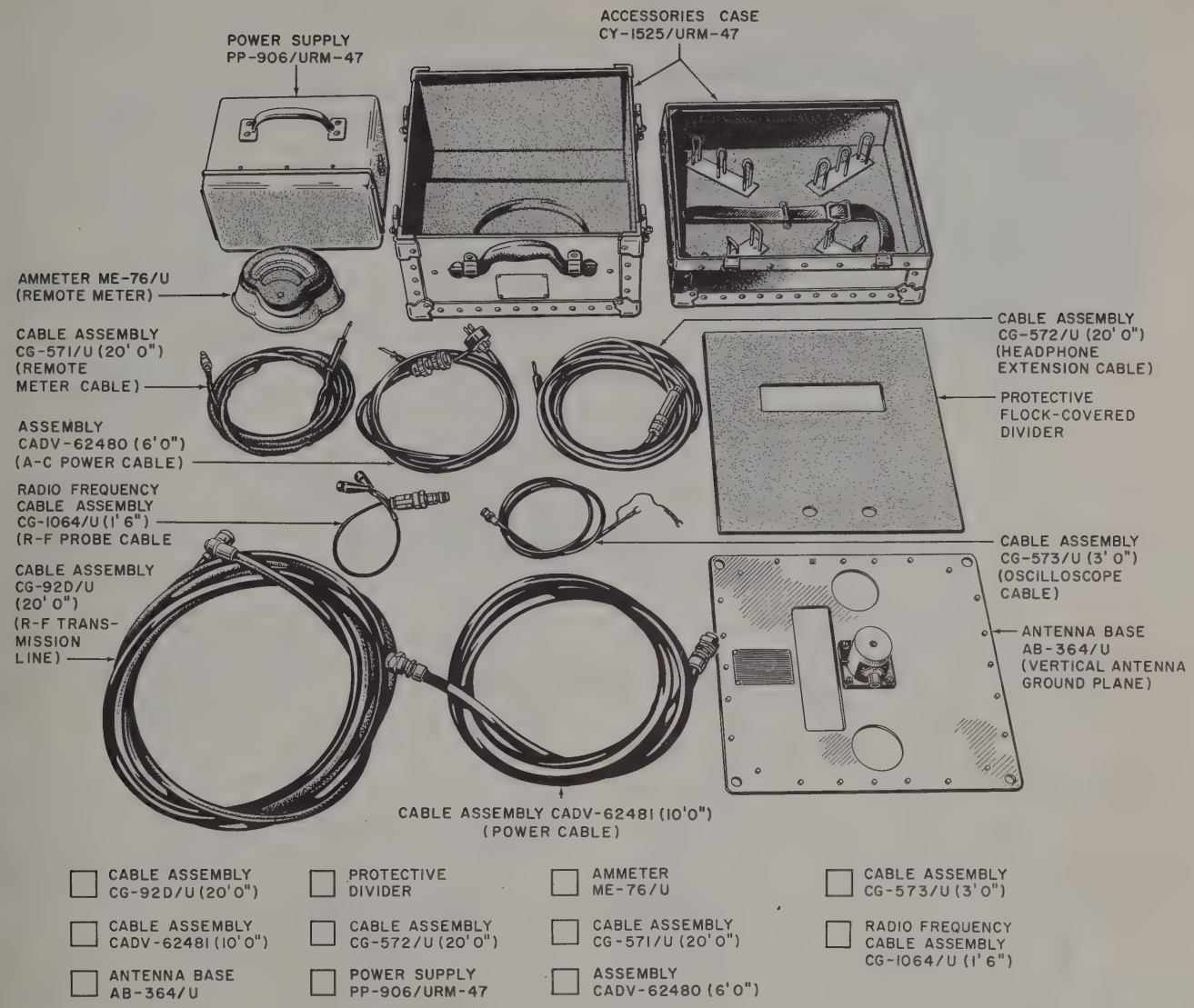
ACCESSORIES CASE CY-1525/URM-47
POWER SUPPLY PP-906/URM-47
AMMETER ME-76/U (REMOTE METER)
CABLE ASSEMBLY CG-571/U (20' 0") (REMOTE METER CABLE)
ASSEMBLY CADV-62480 (6'0") (A-C POWER CABLE)
RADIO FREQUENCY CABLE ASSEMBLY CG-1064/U (1' 6") (R-F PROBE CABLE
CABLE ASSEMBLY CG-92D/U (20' 0") (R-F TRANS-MISSION LINE)
CABLE ASSEMBLY CG-572/U (20' 0") (HEADPHONE EXTENSION CABLE)
PROTECTIVE FLOCK-COVERED DIVIDER
CABLE ASSEMBLY CG-573/U (3' 0") (OSCILLOSCOPE CABLE)
ANTENNA BASE AB-364/U (VERTICAL ANTENNA GROUND PLANE)
CABLE ASSEMBLY CADV-62481 (10'0") (POWER CABLE)
CABLE ASSEMBLY CG-92D/U (20'0")
PROTECTIVE DIVIDER
AMMETER ME-76/U
CABLE ASSEMBLY CG-573/U (3'0")
CABLE ASSEMBLY CADV-62481 (10'0")
CABLE ASSEMBLY CG-572/U (20'0")
CABLE ASSEMBLY CG-571/U (20'0")
RADIO FREQUENCY CABLE ASSEMBLY CG-1064/U (1'6")
ANTENNA BASE AB-364/U
POWER SUPPLY PP-906/URM-47
ASSEMBLY CADV-62480 (6'0")

Figure 1–4. Accessories Case CY-1525/URM-47, Contents Displayed

b. TEST SET CASE CY-1527/URM-47. *(See figure 1–2.)*—Test Set Case CY-1527/URM-47 contains the RI-FI Meter, two instruction books, a pair of Headphones Navy Type –49753 or equivalent, and two Chart Sets PT-188/URM-47.

(1) The RI-FI Meter is the control and metering unit of Radio Interference Measuring Set AN/URM-47. The gray, smooth-finish case of the unit is equipped with a carrying handle and a panel-protective cover held in place by spring clips. Tripod mounting of the RI-FI Meter is provided by means of a round plate on the bottom of the meter case. Water seals under the front panel and at the panel openings make the case substantially drip-proof. See figure 1–3 for a view of the RI-FI Meter with its protective front panel cover removed.

(2) The two instruction books are located in a side compartment of the Test Set Case CY-1527/URM-47. The instruction books should be removed first and their contents read before attempting to set up the equipment for operation.

(3) The Headphones Navy Type – 49753 or equivalent are located in the case cover. The headphones are to be plugged into the PHONES receptacle on the RI-FI Meter front panel for audio indications.

(4) One Chart Set PT-188/URM-47 is held in place in the panel-protective cover of the RI-FI Meter by means of an elastic band. The other chart set is located within the RI-FI Meter case and is also held secure by an elastic band. The charts contain information for calibration settings, correction factors, antenna adjustments, and bandwidth data.

c. ACCESSORIES CASE CY-1525/URM-47. *(See figure 1–4.)*—The Accessories Case CY-1525/URM-47 contains Power Supply PP-906/URM-47, interconnecting cables, Ammeter ME-76/U, and Antenna Base AB-364/U.

Figure 1—5. Power Supply PP-906/URM-47

(1) Power Supply PP-906/URM-47 supplies the plate, bias and filament power for operating the RI-FI Meter. The construction is similar to that of the RI-FI Meter including the drip-proof features of the case. See figure 1—5 for view of the power supply with the protective front panel cover removed.

(2) Seven cables are packed in the accessories case and are located in the case cover. The cables are secured to the case by means of guides and straps. Cable Assembly CG-92D/U (20′ 0″) is the r-f transmission line which is fitted with connectors at both ends and is used to connect the various antennas to the RI-FI Meter RF INPUT receptacle. Radio Frequency Cable Assembly CG-1064/U (1′ 6″) is the r-f probe cable fitted with a connector at one end (for mating with the r-f transmission line) and alligator clips at the other end for connection across a load. The external a-c power source is connected to the power supply by means of the cable Assembly CADV-62480 (6′ 0″) (a-c power cable) which is equipped with a connector at one end and a polarized plug and alligator grounding clip at the other end. Three cable assemblies, Cable Assembly CG-571/U (20′ 0″), Cable Assembly CG-572/U (20′ 0″), and Cable Assembly CG-573/U (3′ 0″) are used to connect the remote meter, Ammeter ME-76/U, the headphones, and an Oscilloscope OS-8/U or equivalent (not supplied), respectively, to the RI-FI Meter. The remote meter cable is equipped with a "microphone" type plug for connection to the REMOTE METER receptacle on the RI-FI Meter front panel and a connector for connection to Ammeter ME-76/U. The headphone extension cable is similarly designed for connection to the PHONES receptacle on the RI-FI Meter front panel and the Headphones Navy Type —49753. The oscilloscope cable is equipped with a connector at one end for connection to the OSCILLOSCOPE receptacle on the RI-FI Meter and two spade lugs at the other end for connection of an oscilloscope. Cable Assembly CADV-62481 (10′ 0″) (power cable) is fitted with a male plug at one end for connection to the POWER OUTPUT receptacle on the power supply and a female plug at the other end for connection to the RI-FI Meter POWER receptacle.

(3) Ammeter ME-76/U is a remote meter similar to that mounted on the RI-FI Meter front panel and is used for giving remote indications. The meter is a d-c type, fan-shaped instrument designed to measure from 0 to 100 microvolts and 0 to 40 db. The internal meter resistance is 1500 ohms with an accuracy of ±1 per cent.

(4) Antenna Base AB-364/U provides support for the antenna elements when used as a vertical antenna over a ground plane. The square aluminum base contains 24 screws around its periphery for attaching ground plane wires. The wires (not supplied) are to be used only when the soil is dry (poor conductivity). The base contains a cylindrical center post for mounting the antenna elements and a receptacle for connection to the r-f transmission line. A hook is also provided for the frequency-calibrated Measuring Tape TL-635/U to determine the length of the antenna elements for the desired frequency.

d. ANTENNA CASE CY-1526/URM-47. *(See figure 1—6.)*—Antenna Case CY-1526/URM-47 contains Mast AB-371/U, Antenna AT-477/U, two Mast Sections AB-363/U, Tripod CADV-10545, Antenna AT-426/U, Antenna Base AB-374/URM-47, Measuring Tape TL-635/U, Right-Angle Adapter UG-27B/U, Azimuth Dial Assembly, Azimuth Pointer Assembly, and a set of seven pairs of antenna elements. These various components are secured in the case by means of blocks, felt pads, straps, and spring-loaded guards.

(1) Mast AB-371/U is a high-frequency dipole antenna whose frequency response may be varied between 88 and 400 mc by the addition of one or two pairs of antenna elements. The antenna contains a balun to transform the symmetrical dipole output into asymmetrical output suitable for loading with a 50-ohm coaxial transmission line. The balun is tuned at each frequency with an adjustable slider. The antenna is constructed of chrome alloy tubing. A knob is provided on the lower part of the antenna to allow tilting through a maximum of 90 degrees either side of the vertical to coincide with the polarization of the incoming signal. A hook is located at the top of the antenna for attaching the frequency-calibrated Measuring Tape TL-635/U when determining the required position of the balun slider and adjusting the length of the antenna elements for the desired frequency. Mast AB-371/U (high-frequency dipole antenna) is designed for mounting on Mast Section AB-363/U which, in turn, is mounted on Tripod CADV-10545. A connector on the high-frequency dipole permits attachment of the r-f transmission line cable.

(2) Antenna AT-477/U is a low-frequency dipole antenna whose frequency response may be varied between 20 and 88 mc by the addition of two to six pairs of antenna elements. A resistive balun is built into the antenna head which converts the balanced output voltage of the antenna to the unbalanced voltage required by the coaxial transmission line. The balun also provides a more suitable impedance match between the transmission line (50 ohms) and antenna terminals (50 ohms nominal). The antenna head also contains a varia-

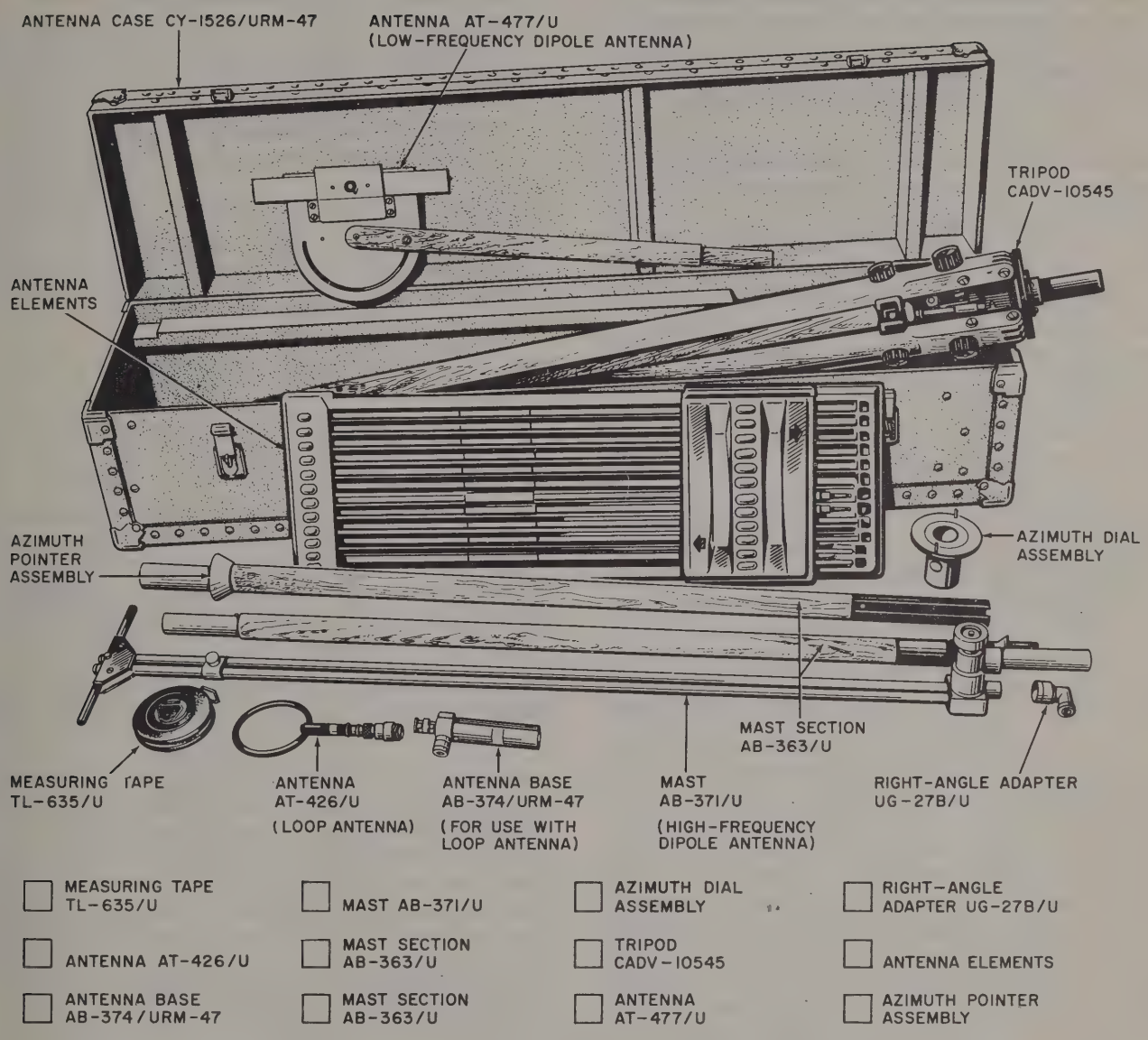

Figure 1–6. Antenna Case CY-1526/URM-47, Contents Displayed

ble, knob-operated inductor. This is used *only* when the antenna is used as a *fixed-length* dipole that is short with respect to a half-wave length. For measurements in confined areas, the dipole length may be adjusted for resonance at 50 megacycles. The knob-operated inductor is in series with the dipole output and is tuned to cancel the capacitive reactance of a short dipole. The low-frequency dipole antenna may also be oriented for polarization purposes. This antenna also contains a hook for attaching the measuring tape, and is designed for mounting on Mast Section AB-363/U.

(3) Mast Section AB-363/U is used for mounting the high- and low-frequency dipole antennas and may be mounted on Tripod CADV-10545. Since two mast sections are supplied, one or both may be used as desired. They are designed so that one can fit onto the other and thus provide increased height for the antennas.

(4) Tripod CADV-10545 is an extendable tripod for mounting the dipole antennas. Its telescoping legs are fitted, at one end, with rubber feet for hard surfaces and, at the other end, with steel spikes for soft surfaces. Each leg contains two locking knobs, one for locking the leg at the desired angle and the other for locking the leg at the desired extension.

(5) Antenna AT-426/U is a shielded loop antenna used for radiation measurements. It is constructed of a single turn of solid, insulated wire which is rubber coated for added insulation properties. Since it is well insulated, it can be used for probing among "hot" wires. The loop antenna can be connected directly to the r-f transmission line cable or may be mounted into Antenna Base AB-374/URM-47, which can then be connected to the r-f transmission line.

(6) Antenna Base AB-374/URM-47 may be used as a hand-held support for the loop antenna, Antenna AT-426/U, or may be inserted into Mast Section AB-363/U for stationary measurements. The base is provided with a connector for connection to the r-f transmission line.

(7) Measuring Tape TL-635/U is a frequency-calibrated tape used for the determination of antenna length for specific frequencies. The tape can be hooked onto the two dipole antennas or the ground plane vertical antenna and the appropriate antenna elements adjusted to correspond with the desired signal frequency.

(8) Right-Angle Adapter UG-27B/U is provided for convenience only, that is, only when a right-angle bend is required or desired in the r-f transmission line. It is connected, at one end, to the r-f transmission line cable and, at the other end, to any of the dipole antennas, the loop antenna, the ground plane vertical antenna, or the r-f probe cable.

(9) The Azimuth Dial Assembly and the Azimuth Pointer Assembly are used to orient the dipole antennas using the magnetic north as a reference point. The Azimuth Pointer Assembly has a truncated conical shape and is marked with an engraved black indicating line. It is secured to Mast Section AB-363/U by means of set screws. The Azimuth Dial Assembly has an engraved circular ring indicating 360 degrees by 10-degree marks. Two sighting pins are provided for proper alignment.

(10) The seven pairs of antenna elements are to be used on the dipole and vertical antennas in the combinations specified in Chart Set PT-188/URM-47 for the desired frequencies. The seven pairs of antenna elements are color-coded for identification. Three pairs of elements have a red-colored band, one pair has a yellow-colored band, another pair has a green-colored band, another pair has a blue-colored band, and the last pair has a white-colored band. All the elements (except the white and blue pairs) have an external thread at one end and an internal thread at the other end and therefore may be screwed into each other or into the antennas. The white and blue pairs of antenna elements have external threads on one end and telescoping sections on the other end and therefore must be used at the extreme ends only.

4. REFERENCE DATA.

a. NOMENCLATURE.—Radio Interference Measuring Set AN/URM-47.

b. CONTRACT NUMBER AND DATE.—NObsr-64089 dated 15 December 1953. See paragraph 1 of this section re serial No. 1 to No. 272.

c. CONTRACTOR.—Stoddart Aircraft Radio Co. Inc., Hollywood 38, California.

d. COGNIZANT NAVAL INSPECTOR.—Inspector of Naval Material, Los Angeles, California.

e. NUMBER OF PACKAGES INVOLVED IN COMPLETE SHIPMENT.—One.

f. TOTAL CUBICAL CONTENTS.

(1) CRATED.—13.9 cubic feet.

(2) UNCRATED.—6.1 cubic feet.

g. TOTAL WEIGHT.

(1) CRATED.—212 pounds.

(2) UNCRATED.—132 pounds.

h. FREQUENCY RANGE.—20 to 400 megacycles covered in six bands:

Band 1	20	to	33 mc
Band 2	33	to	54 mc
Band 3	54	to	88 mc
Band 4	88	to	145 mc
Band 5	145	to	250 mc
Band 6	240	to	400 mc

i. TYPE OF RECEIVER.—Superheterodyne.

j. INTERMEDIATE FREQUENCY.—15 megacycles.

k. SENSITIVITY.—Radiated pick-up using a calibrated, tuned dipole (without reflector), one to 60 microvolts-per-meter, depending on frequency used. Conducted pick-up via a 50-ohm matched coaxial line, one microvolt from 20 to 240 mc, five microvolts from 240 to 400 mc.

l. SELECTIVITY.—Bandwidth at 6 db down from signal level: 138 kc to 175 kc wide throughout all six bands.

m. ACCURACY OF MEASUREMENT.—The accuracy of measurement of continuous wave amplitude modulation, modulated and unmodulated signals, is ±15 per cent or better at signal levels above 10 microvolts when compared to similar outputs from standard signal generators in proper operating condition. Equal accuracy or better is obtained when measuring impulsive signals directly in terms of microvolts-per-kilocycle; these measurements, taken with the PEAK function, are independent of pulse repetition rate.

n. SPURIOUS RESPONSE REJECTION.—Better than 40 db.

o. I-F REJECTION.—Greater than 60 db.

p. AUDIO OUTPUT.—More than 100 milliwatts into a 600-ohm, non-inductive load based on an output meter indication of 10 microvolts and r-f signal input modulated 30 per cent, 1000 cps.

q. OSCILLOSCOPE OUTPUT.—Frequency response flat within 3 db from 20 to 100,000 cps depending on oscilloscope loading.

r. DYNAMIC RANGE OR OVERLOAD.—20 db ± 2 db at full scale.

s. EFFECTIVE RANDOM INTERFERENCE BANDWIDTH.—Varies between 110 and 150 kc, depending upon frequency.

t. TYPE OF RECEPTION.—Carrier, modulated carrier, pulse, or radio interference (noise).

u. INPUT IMPEDANCE.—50 ohms (coaxial). A turret type step attenuator built into the input circuit provides attenuation of the input signal in the following step ratios: 1, 10, 100, 1000, and 10,000. Each step is an electrical continuation of the 50-ohm coaxial line.

v. SHIELDING.—The shielding effectiveness, as referred to the equipment sensitivity using a tuned dipole, is 60 db or better.

w. ELECTRICAL CHARACTERISTICS OF RECOMMENDED ANTENNAS.—The dipole antennas furnished with the equipment shall be used. Other antennas of similar characteristics may be used, but these will require calibration if they are to be used for quantitative measurements.

x. POWER SUPPLY REQUIREMENTS.

(1) VOLTAGE.—105-125 volts rms, or 210-250 volts rms.

(2) PHASE.—Single phase.

(3) FREQUENCY.—50-1000 cps.

(4) POWER.—Approximately 150 watts at 115 volts, 60 cps.

y. HEAT DISSIPATION.—Approximately 150 watts.

TABLE 1—1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	AN DESIGNATION	OVER-ALL DIMENSIONS			VOLUME (Cu. Ft)	WEIGHT (Pounds)
			HEIGHT (In.)	WIDTH (In.)	DEPTH (In.)		
1	Radio Interference Measuring Set consisting of:	AN/URM-47					
1	Test Set Case containing:	CY-1527/URM-47	13-1/2	23-3/4	11-5/16	2.1	50
1	Radio Interference-Field Intensity Meter	IM-88/URM-47	7-5/8	19-13/16	10-3/8		
1	Headphones (GFE)	Navy Type —49753 or equivalent					
2	Chart Set	PT-188/URM-47					
2	Instruction Book	NAVSHIPS 92147(A)	11	8-1/2			
1	Accessories Case containing:	CY-1525/URM-47	16-1/8	15-1/2	10-5/8	1.54	46
1	Power Supply	PP-906/URM-47	7-17/32	10-1/2	8-3/8		
1	Ammeter	ME-76/U					
1	Antenna Base	AB-364/U					
1	Radio Frequency Cable Assembly	CG-1064/U (1′ 6″)					
1	Assembly	CADV-62480 (6′ 0″)					
1	Cable Assembly	CG-573/U (3′ 0″)					
1	Cable Assembly	CG-572/U (20′ 0″)					
1	Cable Assembly	CG-571/U (20′ 0″)					
1	Cable Assembly	CADV-62481 (10′ 0″)					
1	Cable Assembly	CG-92D/U (20′ 0″)					
1	Antenna Case containing:	CY-1526/URM-47	10	40-1/2	10-1/2	2.46	36
1	Mast	AB-371/U					
1	Antenna	AT-477/U					
2	Mast Section	AB-363/U					
1	Tripod	CADV-10545					
1	Antenna	AT-426/U					
1	Antenna Base	AB-374/URM-47					
1	Measuring Tape	TL-635/U					
1	Right-Angle Adapter	UG-27B/U					
1	Azimuth Dial Assembly						
1	Azimuth Pointer Assembly						
1 Set	Antenna Elements						

TABLE 1–2. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVER-ALL DIMENSIONS			VOLUME (Cu. Ft)	WEIGHT (Pounds)
	NAME	DESIGNATION	HEIGHT (In.)	WIDTH (In.)	DEPTH (In.)		
1	Accessories Case Antenna Case Test Set Case	CY-1525/URM-47 CY-1526/URM-47 CY-1527/URM-47	18-7/8	48-3/4	26-1/4	13.9	212

TABLE 1–3. ELECTRON TUBE COMPLEMENT

ELECTRON TUBE TYPE	SYMBOLS INVOLVED	QUANTITY PER EQUIPMENT	RI-FI METER IM-88/ URM-47	POWER SUPPLY PP-906/ URM-47	DESCRIPTION
OA2	V122	1	1		Voltage regulator
OB2	V304	1		1	Voltage regulator
1N63	CR101	1	1		Germanium crystal rectifier
5R4GY	V301	1		1	Full-wave high-vacuum rectifier
5651	V303	1		1	Voltage reference tube
5718	V105	1	1		Reliable subminiature 500-mc medium-mu triode
5726	V111	1	1		Reliable miniature twin diode
5814	V116 V121	2	2		Reliable miniature twin triode
5840	V101 V102 V103 V104	4	4		Reliable subminiature 400-mc r-f pentode, sharp cut-off
6AU6WA (6AU6)	V113 V305	2	1	1	Reliable miniature r-f pentode, sharp cutoff
6BH6	V106 V107 V108 V109 V115 V117	6	6		Miniature r-f pentode
6005 (6AQ5)	V110	1	1		Power amplifier pentode
6080	V302	1		1	Twin triode
6135	V112 V114 V119 V120	4	4		Reliable miniature high frequency triode
Totals		27	22	5	

Note

The tube types within parentheses (6AU6) and (6AQ5) can be substituted for their associated types when absolutely necessary. It is not recommended that tube type substitutions be made for the other tubes of the equipment.

SECTION 2

THEORY OF OPERATION

1. INTRODUCTION.

Radio Interference Measuring Set AN/URM-47 can be used to measure the field intensity of a given radio transmission or to measure the intensity of radiated or conducted radio interference. It can also be used as a sensitive r-f microvoltmeter within its frequency range. Some reference to the nature of these quantities is given here, with a brief description of the methods of measurement employed.

a. The position of the transmitting antenna in space with respect to the earth determines the polarization of the emitted wave. A vertical antenna radiates a wave consisting of a vertical electric field vector and a horizontal magnetic field vector. A horizontal antenna radiates a horizontally polarized wave consisting of a horizontal electric field and a vertical magnetic field.

When the transmitting and receiving antennas are close to the ground, vertically polarized waves yield a stronger signal than do horizontally polarized waves. Using a transmitting antenna several wavelengths above ground, horizontally polarized waves result in a stronger signal close to the earth than is possible with vertical polarization.

A radiated field intercepted by a vertical antenna will set electrons in motion in the antenna. This electron flow constitutes a current that varies in accordance with the variations of the field. In this case the induced current in the rod antenna is not uniform but becomes zero at the top. The voltage effective in producing the current measured at the antenna base is equal to an effective height times the electric intensity of the field. The effective height of an antenna can be described as the calculated true electrical height, corresponding to a perfect antenna that will produce the same field intensity.

When a loop antenna is used, the magnetic component of the radiated field induces a voltage in the loop. The loop output voltage is a function of its area, number of turns, and frequency of excitation.

Vertical rod and loop antennas may be used for field intensity measurements in the portion of the radio spectrum (20 to 400 mc) under discussion. Field intensity is the value of the electric field at a given point and is measured in terms of volts-per-meter. One volt-per-meter is equivalent to a potential of one volt induced in a vertical rod antenna having an effective electrical length of one meter.

There are two principal methods of making field intensity measurements. One method is the substitution method, in which a loop antenna is connected to a receiver, and metering circuits give an indication of the receiver input. The receiver is tuned to the desired signal, the loop is rotated to give maximum signal, and then the indicated value of the received signal is recorded. The loop is then rotated to give minimum received signal, and a signal generator is inserted in series with the loop. The signal generator is tuned to the received frequency and its output adjusted to obtain the same reading of signal input as was obtained with maximum loop signal. The field intensity in microvolts-per-meter is computed from the formula:

$$E = \frac{V}{H\ (eff)}$$

where V is the value of the substitute signal in microvolts and H (eff) is the effective height, obtained from tables or computed as follows:

$$H\ (eff) = 1.351\ ANF \times 10^{-8}$$

where A = area of one turn of loop winding in square inches, N = number of turns, F = frequency in kilocycles, and H (eff) is in meters. The second method of field intensity measurement, as employed in Radio Interference Measuring Set AN/URM-47, uses a specially designed sensitive receiver with built-in attenuators and a calibrating voltage source. The RI-FI Meter is tuned to the desired frequency and the calibrating voltage is applied to the r-f input. The calibrating signal output is standardized by adjustment of the gain in the i-f section. The calibrating signal voltage is turned off and the antenna is connected to the RI-FI Meter input.

The attenuators are adjusted, if possible, for a meter indication at the upper half of the indicating meter dial, and the meter reading thus obtained, multiplied by the attenuator setting, is the field intensity in microvolts-per-meter of the received signal. This method is advantageous in that the accuracy is independent of signal frequency, and depends primarily upon the attenuator and the linearity of the RI-FI Meter circuits. Details of these circuits are discussed in paragraph 3 of this section.

b. Radio interference is defined as an electrical disturbance which causes undesirable response or malfunctioning of electronic equipment. Electronic equipments include radio, radar, sonar, television, electronic detection and recognition, telemetering and control equipments which employ radio frequency energy, transmitted through space or other media for their proper functioning. Interference includes many forms of disturbances and may be roughly classified as continuous and discontinuous. Continuous disturbances include random interference, such as thermal agitation. Atmospheric interference, or static, originating in lightning discharges in local storms and in more distant tropical storms, resembles random interference in that the impulses are frequent and overlap, with sharp peaks exceeding the average level. If interference impulses follow each other rapidly and are not clearly distinguishable, then the interference is random.

Discontinuous interference can be considered to be made up of sharp pulses, the pulse frequency determining the character of the interference. If the pulses are relatively infrequent and clearly separated, the interference is termed impulsive. Impulsive interference may be generated by an internal combustion engine ignition system, power line discharges, electrical switching operations, electronic equipment, and by other electrical and electro-mechanical devices.

Because the frequency spectrum of continuous and discontinuous interference can be extremely wide, the interference magnitude will depend upon the bandwidth of the measuring equipment. The bandwidth characteristics of Radio Interference Measuring Set AN/URM-47 are taken into consideration and are utilized in obtaining average, quasi-peak, and peak values of interference. The procedure for interference measurement is similar to that of field intensity measurement. It is desirable to obtain average, quasi-peak, and peak readings of interference in order to determine the type of disturbance.

Note

A quasi-peak indication represents the "nuisance" value of interference. This measurement is dependent upon the time constants of the second detector circuit and of the indicating meter and is generally less than the "peak" value of the interference. The meter indicating instrument response time is 275 $\pm$75 milliseconds. The circuit time constant is one millisecond charge and 600 milliseconds discharge. The meter time constant is 150 milliseconds or less. These time constants have been generally accepted in the RI-FI Meter design.

2. GENERAL THEORY OF OPERATION.

(See figures 2–1 and 2–2.)

a. GENERAL.–Throughout this section, refer to the complete block diagram, figure 2–1, which shows in detail the relationship of the various circuits within Radio Interference Measuring Set AN/URM-47.

b. R-F INPUT ANTENNAS. *(See figure 2–2.)*–Input devices for Radio Interference Measuring Set AN/URM-47 include high- and low-frequency dipole antennas, a loop probe antenna, and a ground plane vertical antenna.

The high-frequency dipole antenna, Mast AB-371/U, is used with frequency Bands 4, 5, and 6 (88 to 400 mc). The low-frequency dipole antenna, Antenna AT-477/U, is used with frequency Bands 1, 2, and 3 (20 to 88 mc). Both dipoles can be tuned to resonance at any frequency within their respective bands. The dipole antennas have self-contained baluns to transform the symmetrical dipole output into an asymmetrical output suitable for loading with a 50-ohm coaxial transmission line. Meter indications obtained when employing the dipole antennas are to be modified by a factor as determined from the calibration charts. The low-frequency dipole antenna is constructed so that it can also be used for field intensity measurements from 20 to 50 megacycles in confined spaces, employing a fixed-length dipole (tuned to 50 megacycles). A low dipole factor is retained by "tuning out" the capacitive reactance of a short dipole at each frequency by means of a series variable inductance connected between the antenna terminals and the impedance transforming balun.

The loop probe antenna, Antenna AT-426/U, is used within the entire frequency range of the equipment, 20 to 400 mc. It is provided with an insulating coating for probing among uninsulated conductors. Although a calibration chart is supplied for the loop probe antenna, these factors should be considered approximate only and its use is generally limited to relative measurements.

The ground plane vertical antenna, Antenna Base AB-364/U, is an omnidirectional antenna to be used for the entire frequency range of the equipment. A calibration chart (see Chart Set PT-188/URM-47) supplied determines the number of the various antenna extensions to be added to tune the antenna at the desired frequency.

c. RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47.–The RI-FI Meter consists of a highly sensitive h-f and v-h-f superheterodyne radio receiver covering the frequency range of 20 to 400 megacycles.

Measurements can be made with the RI-FI Meter in terms of the peak value of the signal or interference (the PEAK function of the meter), in terms of the weighted value (the QUASI PEAK function), or in terms of the average value (the FIELD INTENSITY function). These functions are selected by means of the function switch. The meter contains internal means for calibrating or standardizing its gain. It is standardized in the CAL position of the function switch at the frequency of operation.

The RI-FI Meter indicating meter scale is directly calibrated for a two-decade, approximately logarithmic range of 1 to 100 microvolts (top scale), and an approximately linear 0 to 40 db (bottom scale) range.

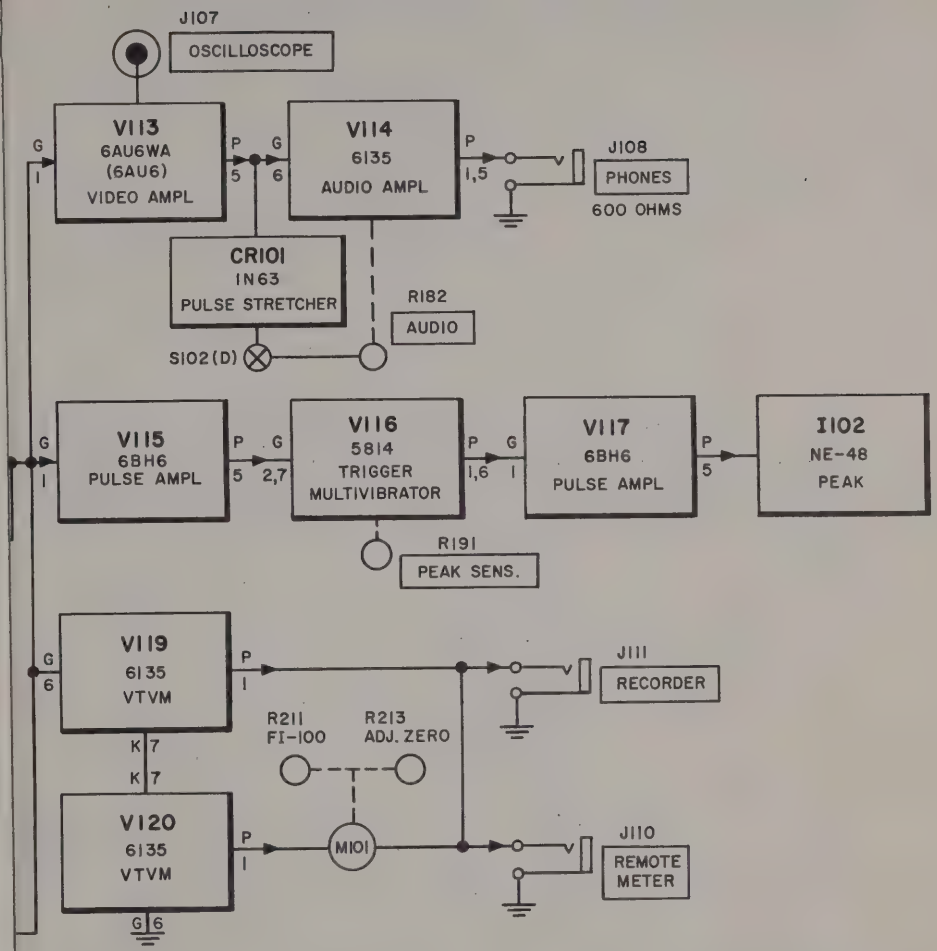

Figure 2–1. Radio Interference Measuring Set AN/URM-47, Overall Block Diagram

b. Radio interference is defined as an electrical disturbance which causes undesirable response or malfunctioning of electronic equipment. Electronic equipments include radio, radar, sonar, television, electronic detection and recognition, telemetering and control equipments which employ radio frequency energy, transmitted through space or other media for their proper functioning. Interference includes many forms of disturbances and may be roughly classified as continuous and discontinuous. Continuous disturbances include random interference, such as thermal agitation. Atmospheric interference, or static, originating in lightning discharges in local storms and in more distant tropical storms, resembles random interference in that the impulses are frequent and overlap, with sharp peaks exceeding the average level. If interference impulses follow each other rapidly and are not clearly distinguishable, then the interference is random.

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The RI-FI Meter indicating meter scale is directly calibrated for a two-decade, approximately logarithmic range of 1 to 100 microvolts (top scale), and an approximately linear 0 to 40 db (bottom scale) range.

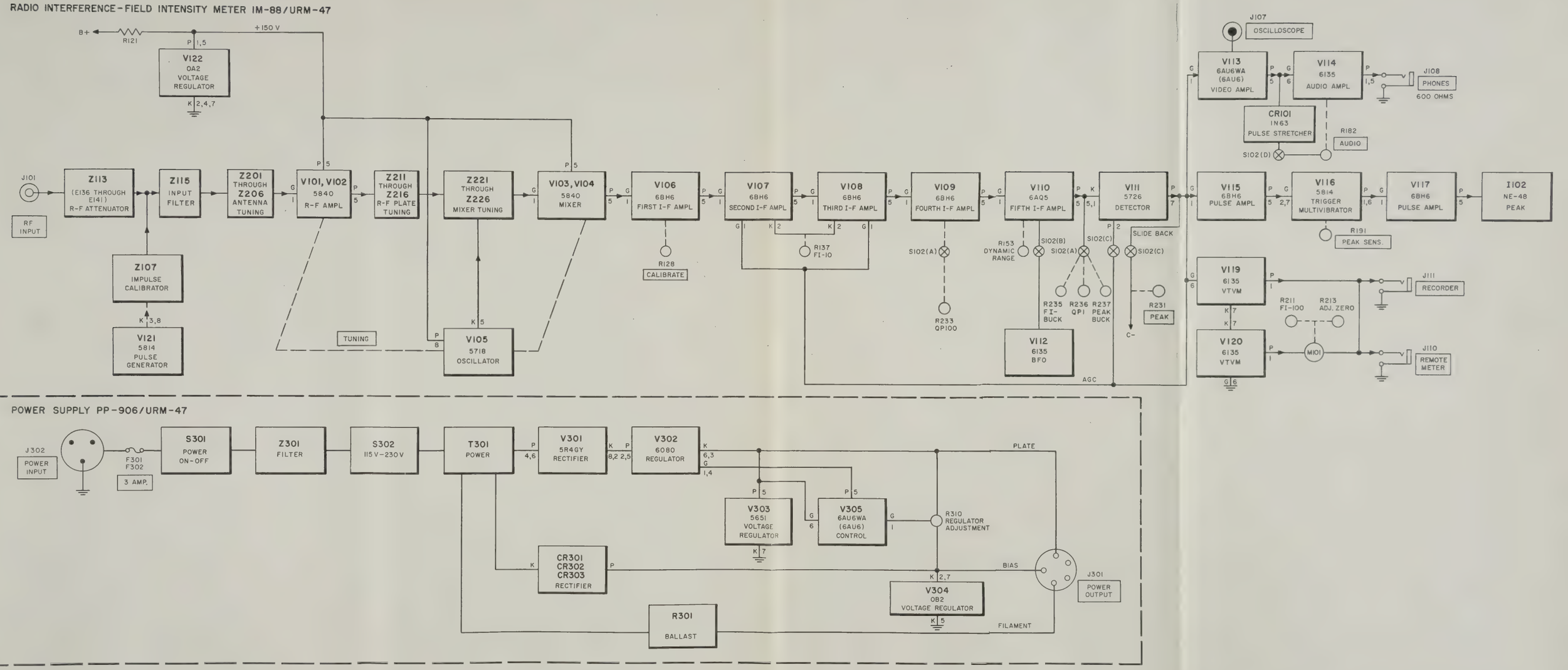


Figure 2–1. Radio Interference Measuring Set AN/URM-47, Overall Block Diagram

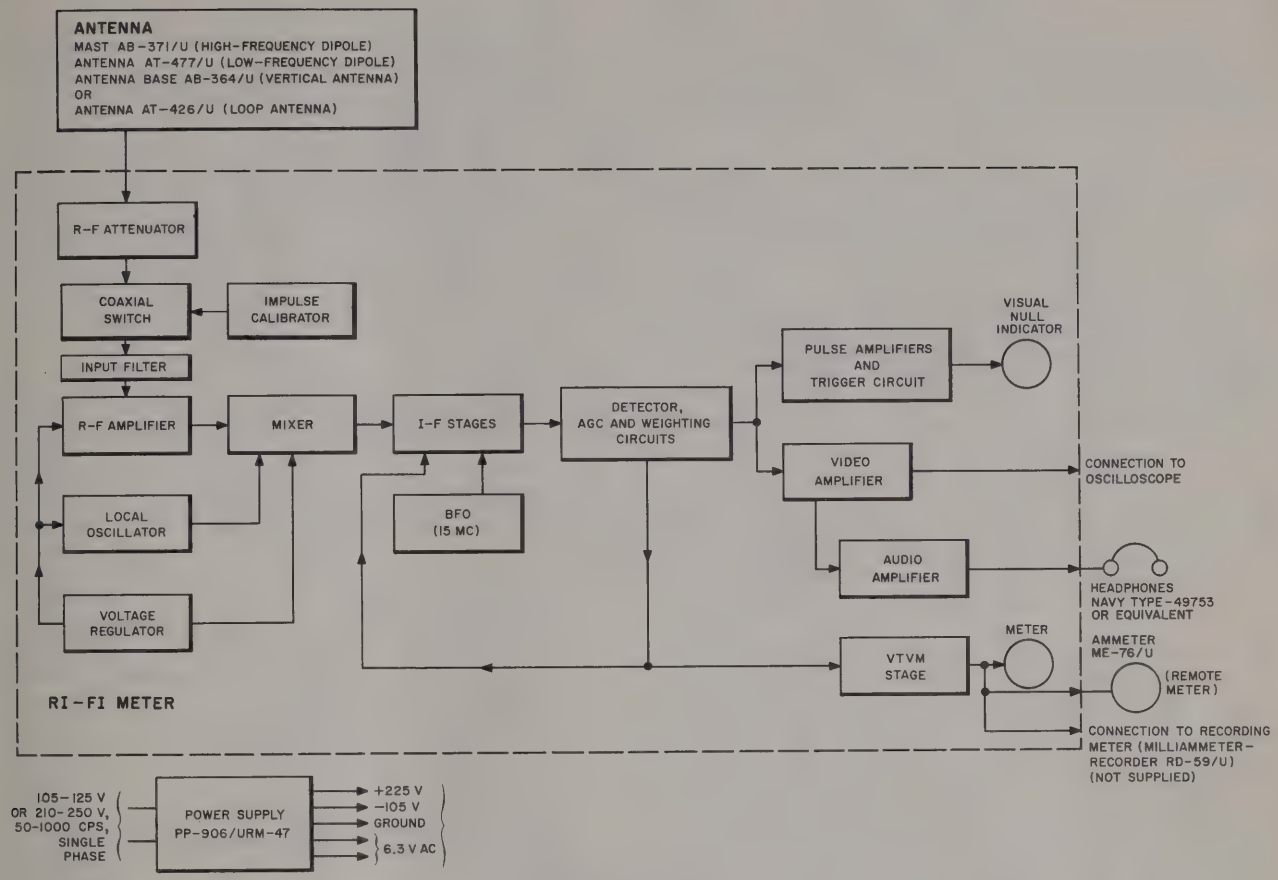


Figure 2–2. Radio Interference Measuring Set AN/URM-47, Simplified Block Diagram

The inherent sensitivity of the RI-FI Meter is one microvolt on Bands 1 through 5 and approximately two to five microvolts on Band 6.

d. SIGNAL CHANNEL IN RI-FI METER.—The signal channel closely resembles a superheterodyne radio receiver in its r-f, i-f, and a-f circuits but differs from most superheterodyne receivers in its provision for r-f attenuation and detector output measurement.

The r-f signal or interference (hereafter called signal) as picked up by the antenna is delivered to the RF INPUT receptacle. The r-f signal passes through the r-f stage, and is mixed with the local oscillator frequency in the mixer stage, to produce the intermediate frequency of approximately 15 megacycles. The intermediate frequency is the same as the BFO crystal frequency so that by use of the BFO a weak signal may be tuned to a null (or near null to produce an audible note), and then the strength of the signal accurately measured with the function switch in the FIELD INTENSITY or QUASI PEAK position. The i-f signal is amplified in five i-f stages and demodulated in the detector stage. The demodulated signal is acted upon by the meter detector weighting circuits and applied to the VTVM stage, thus actuating the meter. The audio components of the signal are subsequently amplified and delivered to the PHONES jack.

F-m signals may be received with reasonable audio quality through the use of "slope detection". This not only simplifies circuitry and minimizes maintenance parts, but also provides fair quality without involved circuits and additional adjustments.

The internal calibrator supplies an impulsive calibrating voltage that follows the same signal path from r-f stage to indicating meter. With the calibrator on (function and attenuator switches in CAL position), the gain of the i-f section can be adjusted.

The built-in step attenuator provides the following step ratios: 1, 10, 100, 1000, and 10,000. The attenuation is obtained in the input to the r-f and i-f stages. The attenuation steps are listed as follows:

R-f Attenuator Settings	*Attenuation in db*	
	R-f	*I-f*
CAL	0	20
X1	0	0
+0DB		
X10	0	20
+20DB		
$X10^2$	20	20
+40DB		

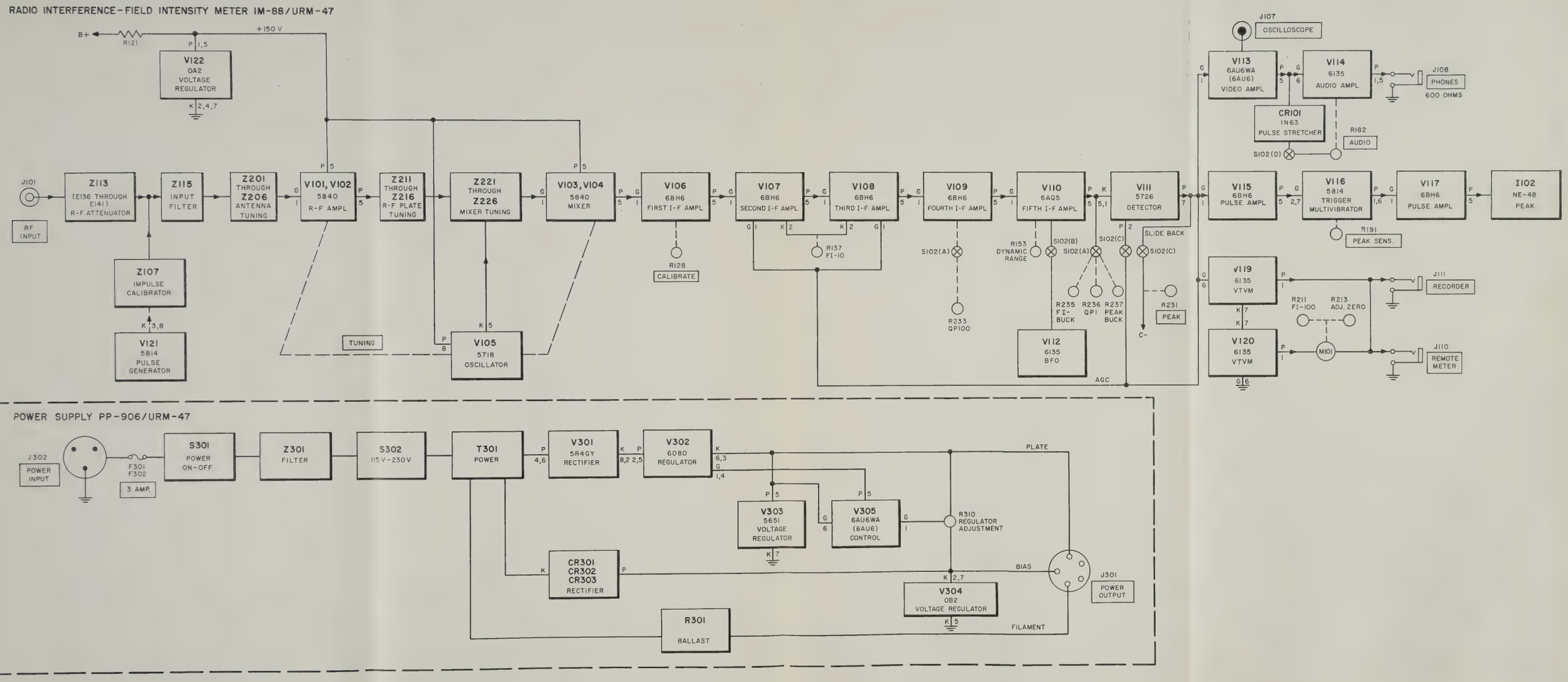


Figure 2–1. Radio Interference Measuring Set AN/URM-47, Overall Block Diagram

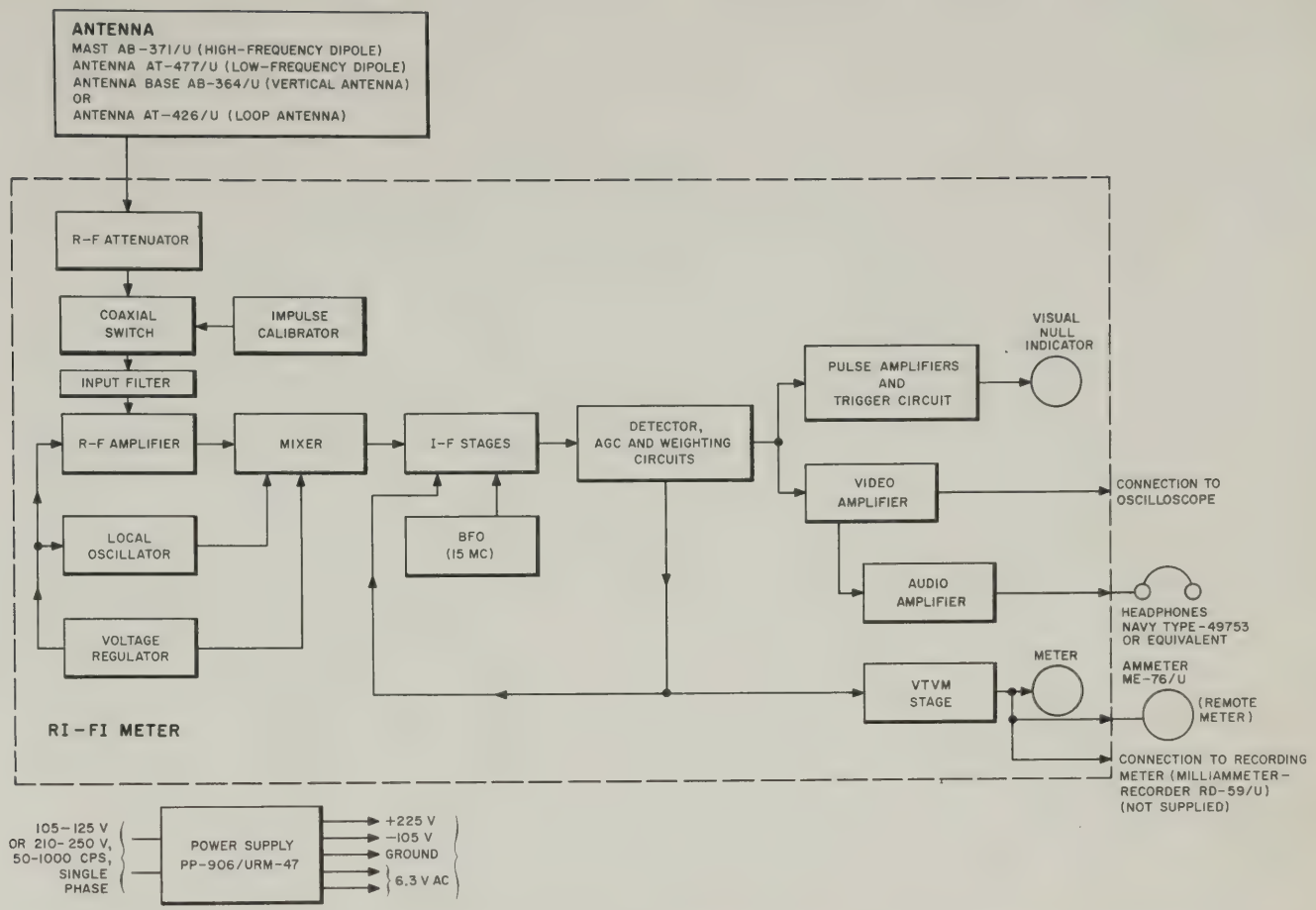


Figure 2–2. Radio Interference Measuring Set AN/URM-47, Simplified Block Diagram

The inherent sensitivity of the RI-FI Meter is one microvolt on Bands 1 through 5 and approximately two to five microvolts on Band 6.

d. SIGNAL CHANNEL IN RI-FI METER.—The signal channel closely resembles a superheterodyne radio receiver in its r-f, i-f, and a-f circuits but differs from most superheterodyne receivers in its provision for r-f attenuation and detector output measurement.

The r-f signal or interference (hereafter called signal) as picked up by the antenna is delivered to the RF INPUT receptacle. The r-f signal passes through the r-f stage, and is mixed with the local oscillator frequency in the mixer stage, to produce the intermediate frequency of approximately 15 megacycles. The intermediate frequency is the same as the BFO crystal frequency so that by use of the BFO a weak signal may be tuned to a null (or near null to produce an audible note), and then the strength of the signal accurately measured with the function switch in the FIELD INTENSITY or QUASI PEAK position. The i-f signal is amplified in five i-f stages and demodulated in the detector stage. The demodulated signal is acted upon by the meter detector weighting circuits and applied to the VTVM stage, thus actuating the meter. The audio components of the signal are subsequently amplified and delivered to the PHONES jack.

F-m signals may be received with reasonable audio quality through the use of "slope detection". This not only simplifies circuitry and minimizes maintenance parts, but also provides fair quality without involved circuits and additional adjustments.

The internal calibrator supplies an impulsive calibrating voltage that follows the same signal path from r-f stage to indicating meter. With the calibrator on (function and attenuator switches in CAL position), the gain of the i-f section can be adjusted.

The built-in step attenuator provides the following step ratios: 1, 10, 100, 1000, and 10,000. The attenuation is obtained in the input to the r-f and i-f stages. The attenuation steps are listed as follows:

R-f Attenuator Settings	*Attenuation in db*	
	R-f	*I-f*
CAL	0	20
X1	0	0
+0DB		
X10	0	20
+20DB		
$X10^2$	20	20
+40DB		

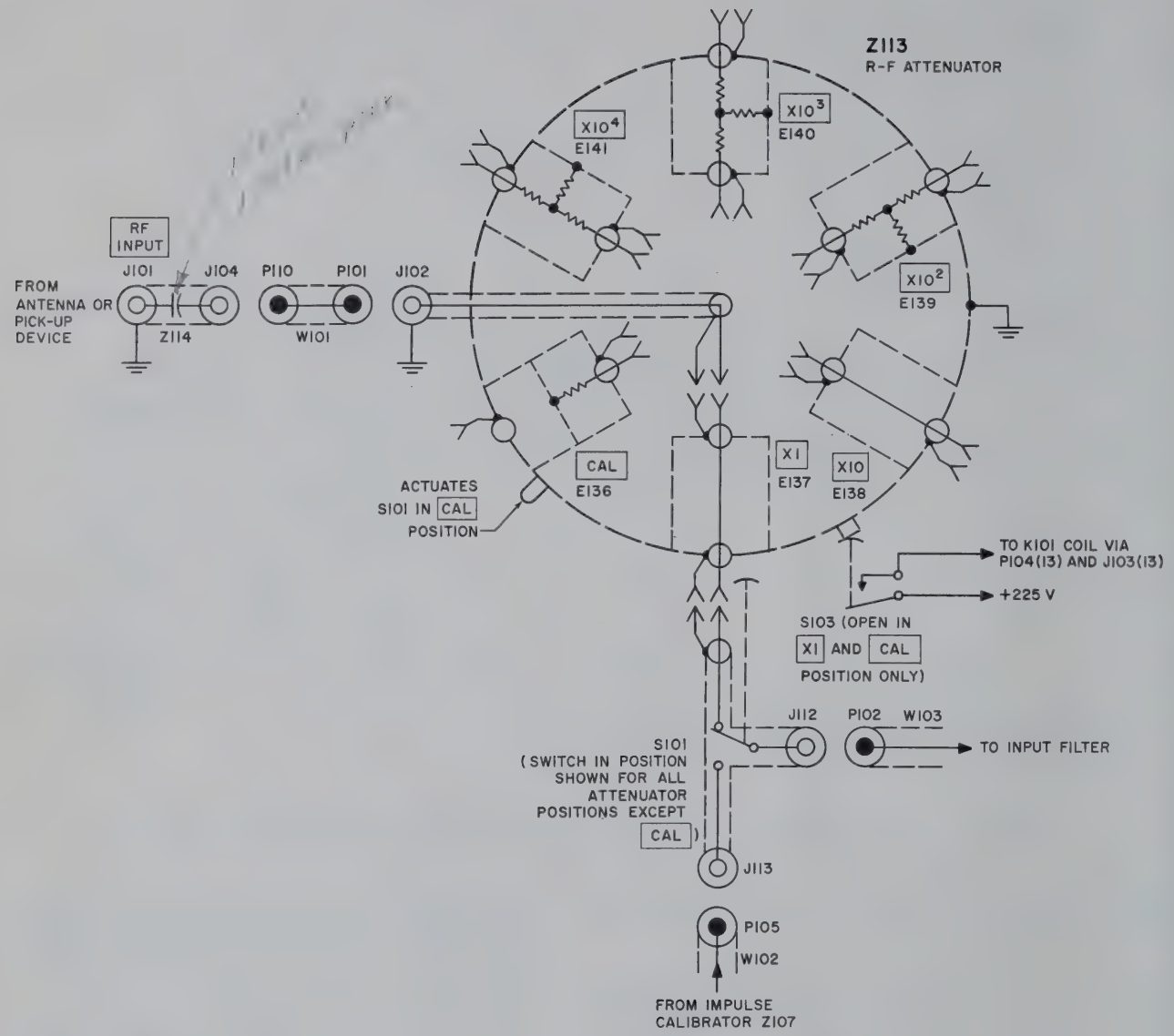


Figure 2–3. R-f Attenuator and Input Stages, Simplified Schematic Diagram

R-f Attenuator Settings	*Attenuation in db*	
	R-f	*I-f*
$X10^3$	40	20
+60DB		
$X10^4$	60	20
+80DB		

3. DETAILED THEORY OF OPERATION, RI-FI METER.

(See figures 2–1 through 2–35.)

The individual circuits of the RI-FI Meter are described in the following subparagraphs.

a. R-F ATTENUATOR AND INPUT STAGES. *(See figure 2–3.)*—The r-f attenuator Z113 consists of an assembly of six metal tubes (E136 through E141) mounted in a turret arrangement on a central shaft which imparts both rotational and linear motion to the assembly. Of the six tubes, three contain T-section resistive networks, two are "straight-through" sections for zero attenuation, and one provides for the injection of a calibrating signal generated within the unit. Selection of each step of attenuation is accomplished by a pull-turn-push sequence in the actuation of the shaft (by means of the PULL-TURN-PUSH control of the r-f attenuator Z113). Smooth, positive positioning is accomplished by a spring-loaded detent.

The resistive elements sealed within the tubes are special one-watt resistors consisting of thin metallic films on ceramic discs. Their precision resistance values are maintained throughout the frequency range of the equipment, 20 to 400 megacycles.

Note

Tests have indicated that the attenuator pads easily handle one watt of sine wave power, but that a different condition exists on pulse type inputs. It is not the average *power* of a sharply pulsed signal which damages the attenuator elements, but the peak voltage of the signal. The type of resistive elements used is such that with a pulse of 1000 pps at four microseconds duration, the maximum peak *voltage* which can be accommodated is about 100 volts applied to the input connector.

The six positions of the attenuator are listed in the following table with the corresponding amounts of attenuation presented to the r-f input signal. It is to be noted that the *attenuation listed here is the attenuation presented by the r-f attenuator Z113 alone;* subsequent attenuation is introduced at the input to the i-f stages (see subparagraph 3.*d*, following).

Position	*R-f Attenuation (db)*
CAL	*
X1 +0DB	0
X10 +20DB	0
$X10^2$ +40DB	20
$X10^3$ +60DB	40
$X10^4$ +80DB	60

*In the CAL position of the attenuator, the input signal is terminated into 50 ohms resistive load within tube E136; this is done to prevent leakage of any input signal into the r-f circuits during calibration procedures.

The input signal from one of the antennas or pick-up devices is fed into the RF INPUT jack J101 (part of coupling section Z114) and then via J104 (also part of Z114) through cable W101 and its associated connectors P110 and P101 to the signal input connector J102 of the r-f attenuator (see figure 2–3). At this point the input signal passes through the attenuator tube (E137 through E141) selected by the r-f attenuator PULL-TURN-PUSH control Z113 to the coaxial switch S101 on the rear of the assembly.

Note

If the CAL position of the attenuator control has been selected, the incoming signal will terminate into 50 ohms resistive load in tube E136.

In all positions of the attenuator control except CAL, switch S101 is closed to deliver the input signal to the r-f stage via coaxial connectors J112 and P102.

In the X1 position, a pin on the attenuator turret assembly actuates switch S103 (i.e., opens the normally closed switch) to de-energize relay K101 in the first i-f amplifier stage. When relay K101 becomes de-energized, its contacts remove the additional attenuation provided for in that system (see subparagraph 3.*d*, following). In all other positions, S103 is not actuated.

In the CAL position, another pin on the attenuator turret assembly actuates coaxial switch S101 to connect J112 to J113. This permits the calibrating signal from the impulse calibrator Z107 to be injected into the r-f stage for calibrating purposes.

b. INPUT FILTER STAGE. *(See figure 2–4.)*—The input filter Z115 is a transmission line low-pass filter for attenuating frequencies above the tuning range of the RI-FI Meter. It uses sections of coaxial line having large impedance with respect to 50 ohms as inductance elements and sections of coaxial line having small impedance with respect to 50 ohms as capacitance elements. It consists of six constant-K sections, including matching input and output sections. The nominal cutoff frequency of this filter is 470 megacycles.

c. R-F STAGES. *(See figures 2–5 through 2–9.)*—

Note

In the following paragraphs, the description of the operation will be made in terms of only one of the six combinations of tuning elements on any turret assembly. The operation in the other five bands (i.e., for other combinations) is the same in all cases.

(1) GENERAL. *(See figure 2–5.)*—The r-f stages consist of the impedance matching network (Z200), the push-pull r-f amplifiers V101 and V102 (with tuned input and output circuits), local oscillator V105, and the push-pull mixers V103 and V104 (with tuned input circuit). The impedance matching network consists of

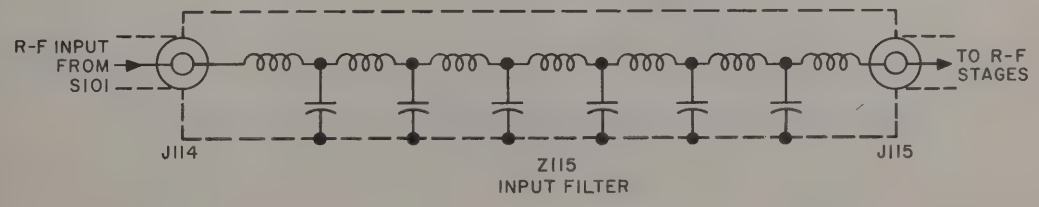


Figure 2–4. Input Filter Stage, Simplified Schematic Diagram

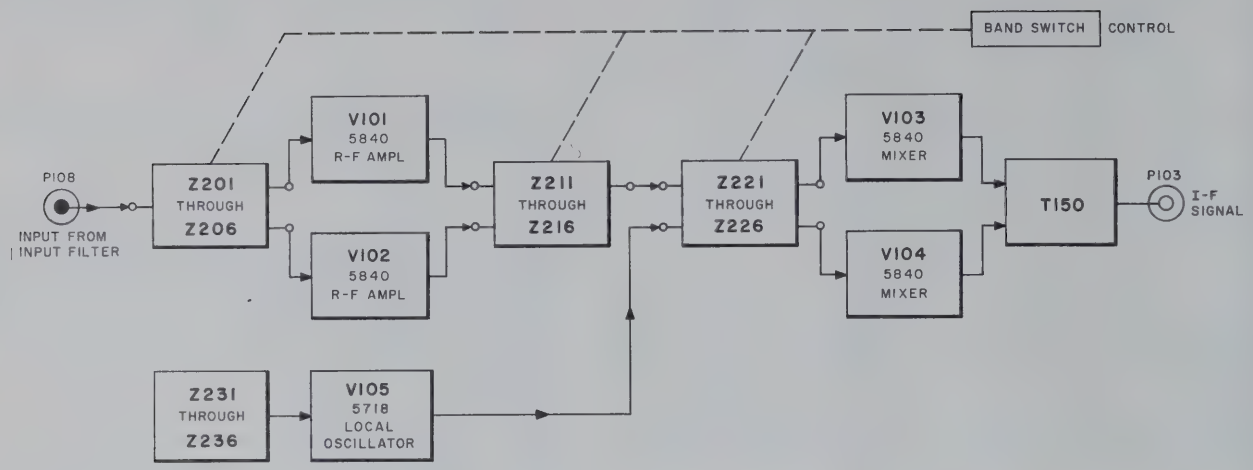


Figure 2–5. R-f Stages, Block Diagram

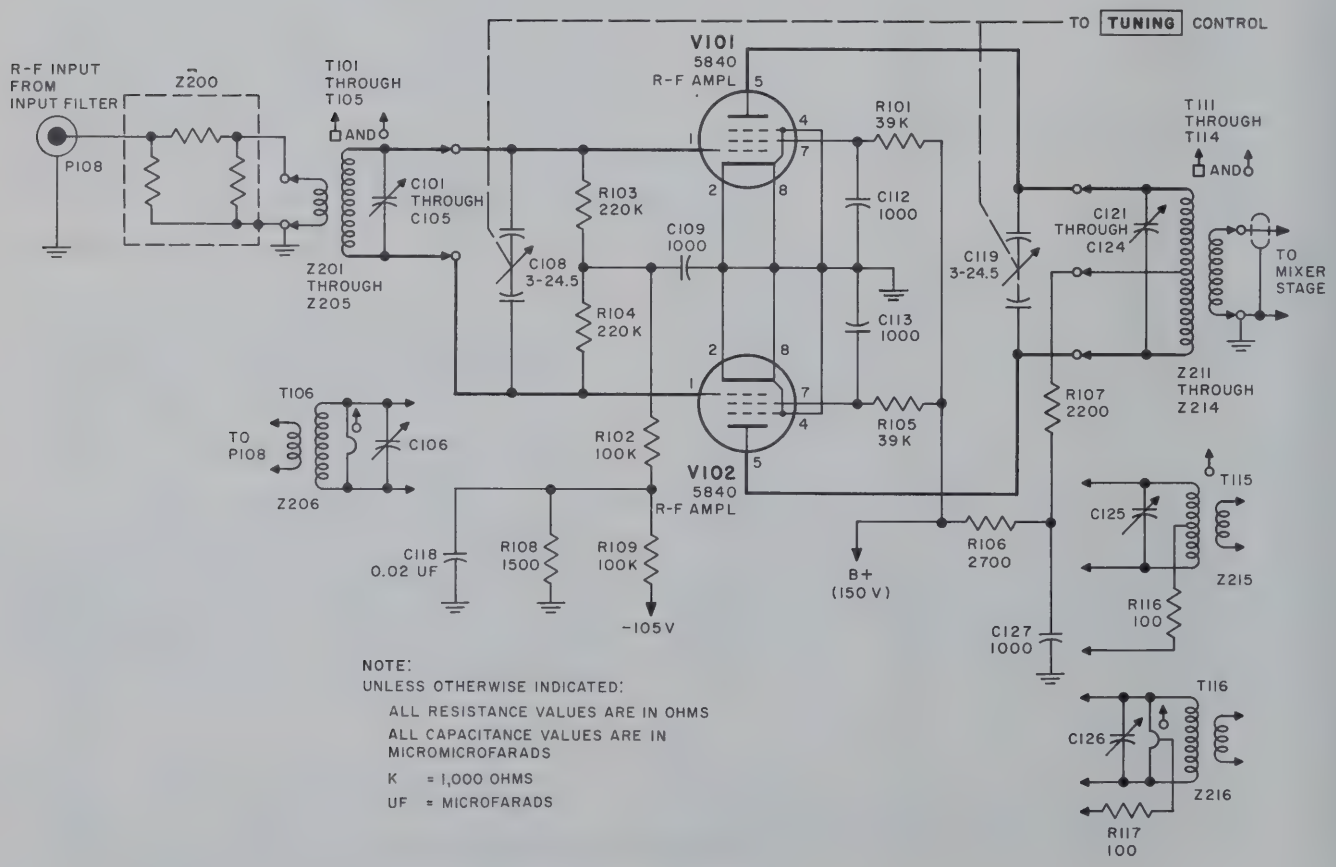


Figure 2–6. R-f Amplifier Stage, Simplified Schematic Diagram

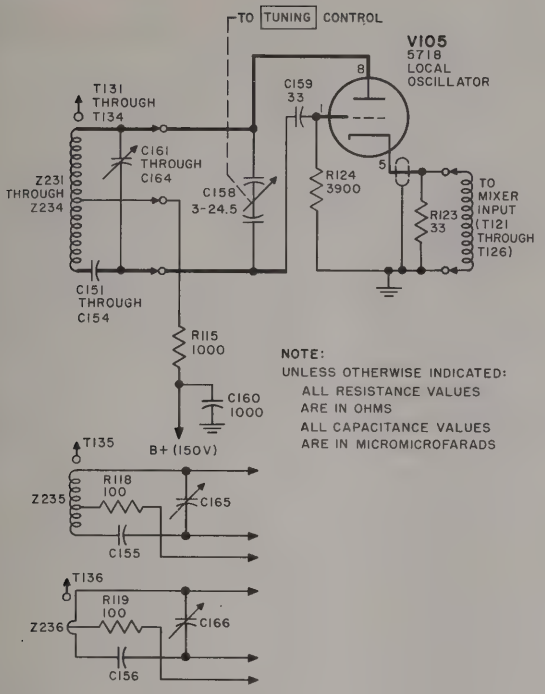


Figure 2–7. Local Oscillator Stage, Simplified Schematic Diagram

three composition resistors which serve to maintain the input impedance at a relatively constant value throughout the frequency range of the equipment. Each of the tuned circuits consists of a tuning capacitor and a turret assembly of six transformer and trimmer capacitor combinations (one combination for each band). The tuning capacitors are ganged and are driven by the TUNING control (H). Each tuned circuit (i.e., capacitor and its turret assembly) is contained within a shielded compartment of the r-f head. The turret assemblies are ganged and are driven by the BAND SWITCH control (G).

(2) R-F AMPLIFIER STAGE. *(See figure 2–6.)*—The r-f signal from S101 on the attenuator assembly is applied through P102 to the primary winding of T101 whose secondary is tuned by C108 (C101 is the associated trimmer). The r-f signal is applied directly to the grids of V101 and V102. These grids are biased negatively from the −105-volt supply through the voltage divider composed of R109 and R108, and through the grid resistors R102, R103 and R104. The amplified output, taken from the plates of V101 and V102, is applied to the tuned output circuit C119, T111, and C121. The output from T111 is coupled by means of a link at a low impedance level to the succeeding mixer stage.

(3) LOCAL OSCILLATOR STAGE. *(See figure 2–7.)*—The local oscillator stage consists primarily of triode V105, transformer T131, tuning capacitor C158, and trimmer C161 arranged in a modified Colpitts circuit. The oscillator output is always 15 megacycles higher than the signal frequency. Grid bias is provided by resistor R124. The oscillator signal is connected from the cathode circuit at a low impedance level to the mixer stage.

(4) MIXER STAGE. *(See figure 2–8.)*—The mixer stage consists primarily of mixer tubes V103 and V104, input transformer T121, tuning capacitor C137, trimmer C131, and output coupling transformer T150. Input signals from the r-f amplifier stage and from the local oscillator stage are applied separately at a low imped-

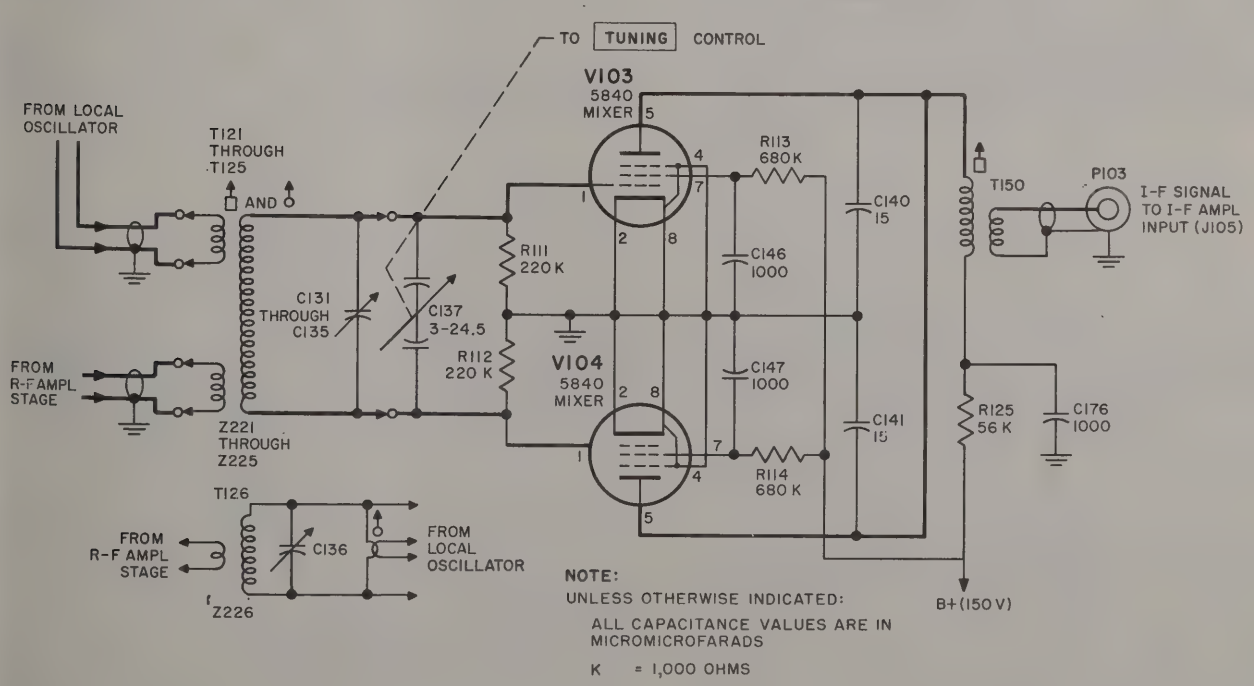


Figure 2–8. Mixer Stage, Simplified Schematic Diagram

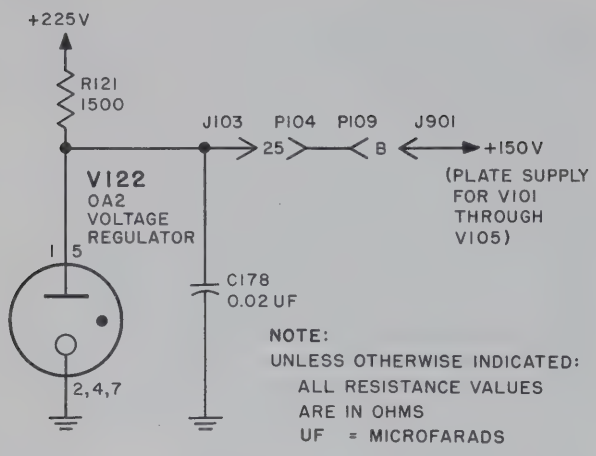


Figure 2–9. Voltage Regulator Stage, Simplified Schematic Diagram

ance level to the two primary windings of T121. Simultaneous signals occur in the secondary winding of T121 and the two signals are applied in push-pull to the grids of V103 and V104. The i-f signal output of these tubes (difference frequency between the two input signals) is taken from the plates, connected in parallel, and applied to the primary of the output coupling transformer T150, which is tuned to the intermediate frequency of 15 megacycles. The low impedance output of the secondary winding of T150 is delivered through connector P103 to the i-f amplifier stages.

(5) VOLTAGE REGULATOR STAGE. *(See figure 2–9.)*—The plates of the tubes within the r-f stages (V101 through V105) must be energized from a well-regulated voltage supply in order to maintain the required stable operation. This regulated supply (+150 volts) is obtained from the +225-volt system supply (Power Supply PP-906/URM-47) through dropping resistor R121 to the plate of voltage regulator V122. Capacitor C178 provides additional filtering and stabilizing of the regulated supply voltage.

d. I-F AMPLIFIER AND DETECTOR STAGES. *(See figures 2–10 through 2–15.)*

(1) GENERAL. *(See figure 2–10.)*—The i-f amplifier and detector stages consist of five i-f amplifiers V106 through V110, a second detector V111, and a BFO V112, all mounted on the same chassis. These stages, together with associated AGC and weighting circuits, function selector switch S102, and a calibration control R128 are shown in the block diagram of figure 2–10. The i-f amplifier circuits are all tuned to the intermediate frequency, 15 megacycles. Permeability-tuned transformer coupling is employed between all stages. The plate and heater voltage supplies of each stage are filtered and provided with decoupling networks to reduce the common impedance between stages. In this manner, feedback between stages is prevented. To provide attenuation, gain, and AGC features in the i-f system, several of the i-f stages are operated at different levels of tube operating bias. Compensation is required for the resulting Miller effect, which is evidenceed by a certain amount of detuning due to variation (with signal strength) of the capacitance across the tuned grid circuit. In the method used here, a partially unbypassed cathode resistance in combination with the capacitance from grid to cathode of a tube introduces feedback between the cathode and grid circuits. This, in effect, reduces the capacitance between grid and ground with increasing transconductance, and thereby tends to compensate for the undesired detuning.

(2) INPUT AND FIRST I-F AMPLIFIER STAGE. *(See figure 2–11.)*—The i-f signal from the r-f stages is introduced at J105 and applied to the primary winding of transformer T151. The secondary of T151 is tuned to 15 megacycles (the intermediate frequency) by the series-connected capacitors C183 and C182. In the X1 position of the r-f attenuator, the output from the sec-

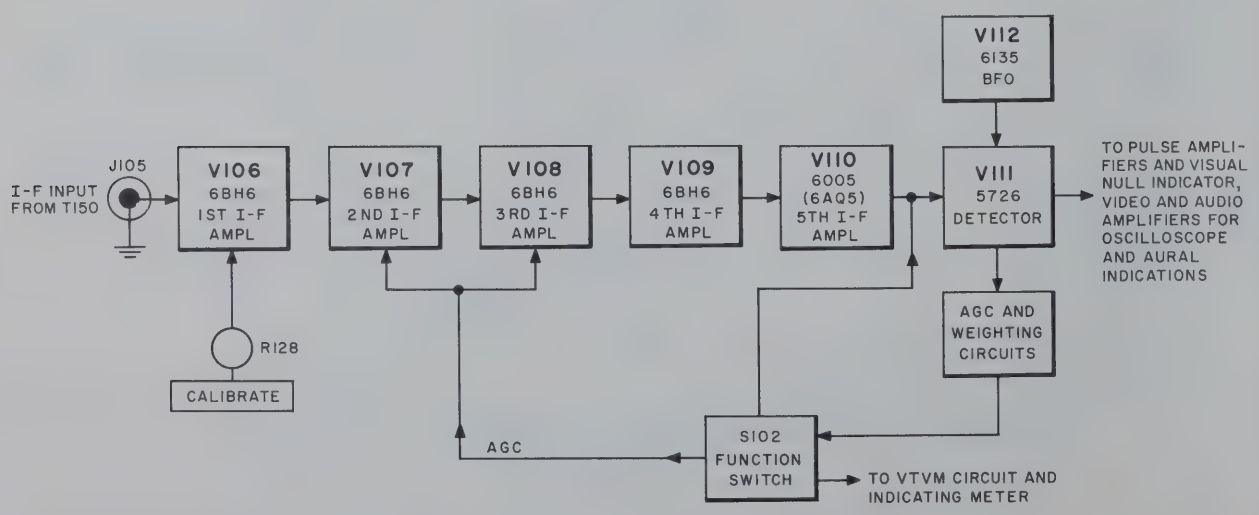


Figure 2–10. I-f Amplifier and Detector Stages, Block Diagram

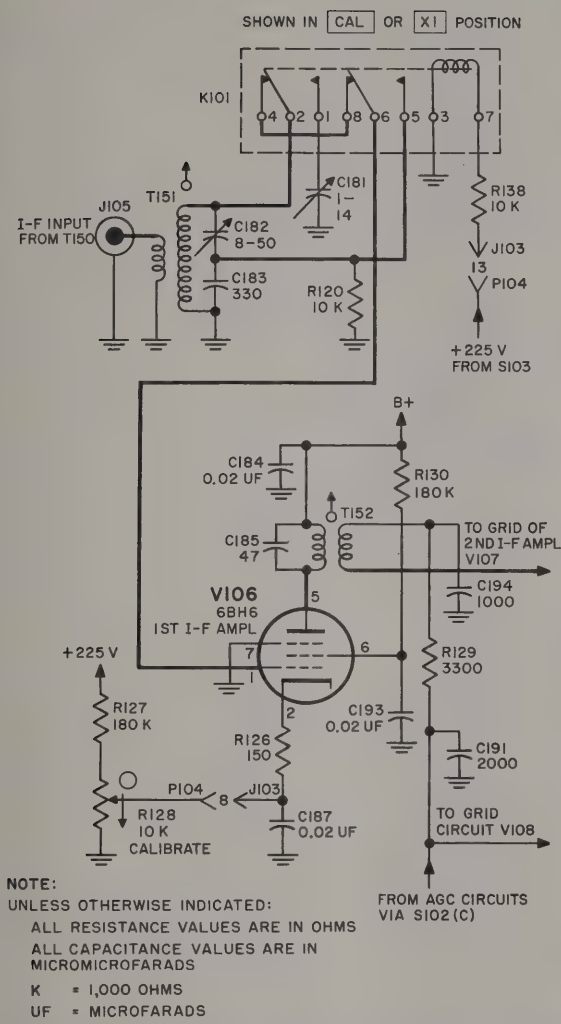


Figure 2–11. Input and First I-f Amplifier Stage, Simplified Schematic Diagram

ondary of T151 is delivered to the grid of the first i-f amplifier V106 through contacts 2, 4, 8, and 6 of relay K101 whose coil is not energized (see paragraph 3.*a*, preceding). In effect no attenuation is introduced into either the r-f or i-f signal. In all other positions of the r-f attenuator, relay K101 becomes energized, and the grid of the first i-f amplifier is fed from the tuned circuit of T151 (junction of capacitors C183 and C182) via contacts 5 and 6 of K101. Capacitors C183 and C182 form a capacitive voltage divider to introduce an effective fixed attenuation of 20 db into the i-f input signal. At the same time, capacitor C181 is connected in parallel with T151 secondary (via contacts 1 and 2 of K101). The addition of C181 compensates for the change of the grid-to-ground capacitance of i-f amplifier V106 across T151 secondary and thereby prevents detuning. Resistor R120 is connected between the junction of C182 and C183 and ground to provide a d-c return path for the grid circuit of V106; its value is chosen low enough to permit satisfactory grid current flow and high enough to prevent loading of T151. Resistor R126 constitutes the unbypassed portion of the cathode resistance (see subparagraph (1), immediately preceding). The adjustable CALIBRATE control R128 (which together with R127 forms a voltage divider) introduces a positive bias in the cathode circuit. This control functions as the gain control for the entire unit.

The first i-f amplifier stage functions primarily as a buffer stage and provides calibration control and input attenuation facilities rather than substantial gain. The output is taken from the plate of V106 and is coupled to the succeeding stage (second i-f amplifier V107) through transformer T152 which is tuned to 15 megacycles. Capacitor C185 is connected across the primary winding of T152 to achieve the specified bandwidth and selectivity requirements. A similar capacitor is connected across the primary winding of the coupling transformer in each of the succeeding stages for the same purpose. The secondary of T152 forms part of the return path for the grid of the succeeding tube V107; this path eventually returns to the AGC circuits. Resistor R129 and capacitors C191 and C194 constitute a decoupling circuit to prevent detuning of T152. The values of C191 and C194 are sufficiently small to minimize degeneration (lengthening) of AGC time constants.

(3) SECOND AND THIRD I-F AMPLIFIER STAGES. *(See figure 2–12.)*—The second and third i-f amplifiers V107 and V108 constitute AGC-controlled meter-scale tracking control stages. The circuits of both stages are functionally identical. Both circuits have unbypassed cathode resistors (R132 and R136, respectively). The grids of both tubes are supplied with AGC voltage through the secondary winding of the coupling transformer of the preceding stage. The operating bias for both tubes is controlled by the adjustment of the FI-10 potentiometer R137 which is used to establish correct meter scale tracking. A decoupling network composed of resistor R133 and capacitors C205 and C208 prevents detuning of transformer T153.

The output from the third i-f amplifier stage V108 is coupled via T154 directly to the grid of the succeeding stage (fourth i-f amplifier V109).

(4) FOURTH AND FIFTH I-F AMPLIFIER STAGES. *(See figure 2–13.)*—The fourth i-f stage V109 is an equalizing or gain-compensation stage. The input from the third stage V108 is applied directly to the grid of V109. (The grid circuit of V109 is returned to ground via transformer T154.) The bias of the cathode circuit of V109 can be changed by means of the function switch S102(A); appropriate values are inserted so that the gain of the stage can be adjusted to provide the same output level from detector tube V111 for quasi-peak, field intensity, and peak operation. The output of V109, taken from the plate, is coupled via T155 directly to the grid of the succeeding i-f stage V110.

The fifth i-f stage V110 is a power driver stage employing a power amplifier pentode in a high-gain circuit with high dynamic range (overload capacity). Resistor

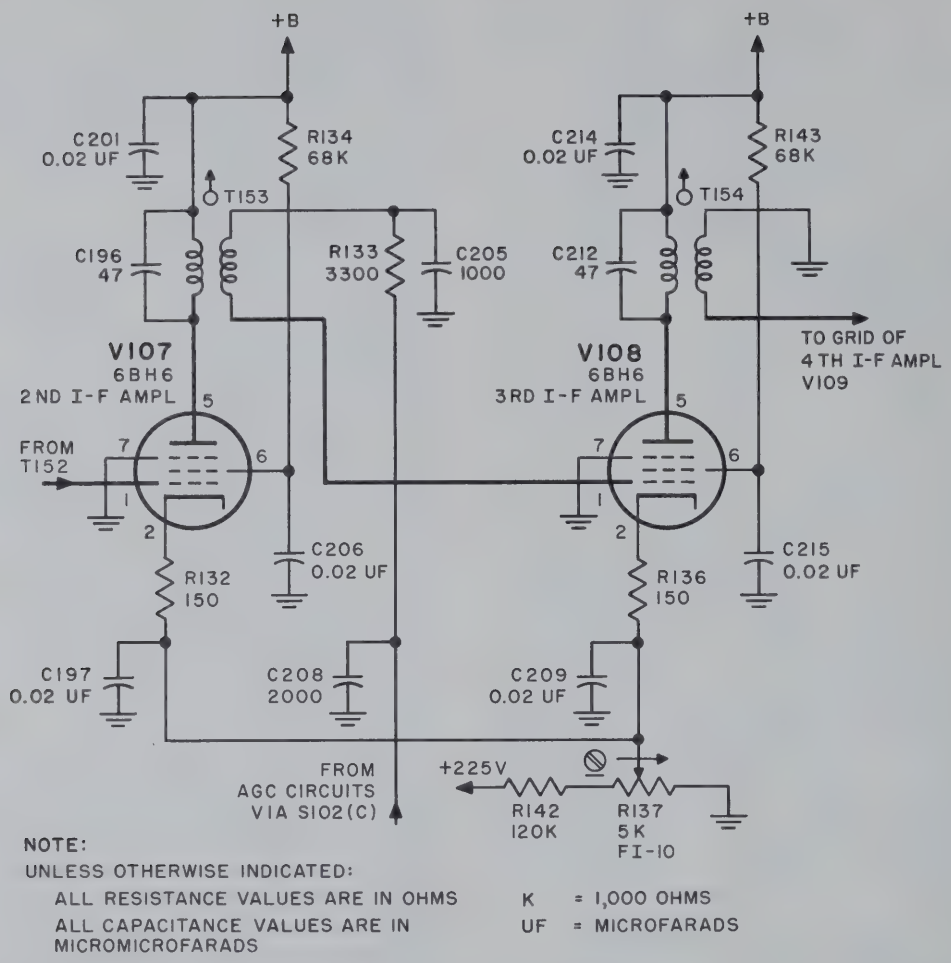


Figure 2–12. Second and Third I-f Amplifier Stages, Simplified Schematic Diagram

R149 provides the cathode bias for this stage. Screen grid neutralization is obtained by a voltage tapped off the voltage divider formed by the primary winding of T156 and capacitor C237; this voltage is coupled to the screen grid through coupling capacitor C238. The dynamic range of the stage is controlled by the variable resistor R153 in the plate and screen circuits. The output of this stage is coupled via T156 to the cathodes of the detector stage V111.

(5) DETECTOR STAGE. *(See figure 2–14.)*—The diode detector V111 demodulates the i-f signal applied to its cathodes from T156. One of the diodes of V111 delivers its output from the plate (pin 7) to two branch circuits. One branch output is applied through r-f choke L106 to the pulse amplifier V115 (for the visual null indicator circuits) and the video amplifier V113 (and the following audio circuit). The second branch output from the plate (pin 7) is applied to the AGC and VTVM circuits in the FIELD INTENSITY, PEAK, CAL, and BFO positions of the function switch. Resistor R164 is the load resistor in this case. The other diode supplies an output from the plate (pin 2) to the AGC and VTVM circuits in the QUASI PEAK position of the function switch S102 only; the diode load resistor in this case is resistor R163 connected by S102C.

(6) BFO STAGE. *(See figure 2–15.)*—The BFO stage V112 is provided for use in the detection of unmodulated (c-w) signals. It consists of a crystal-controlled oscillator operating at the intermediate frequency (15 mc) of the system. The impedance Z106, tuned to 15 megacycles, is in the plate supply line to increase the output signal. This oscillator is actuated only in the BFO position of the function switch S102. In this case, the AGC circuits are not active, the meter circuit is disconnected, and the equipment operates at maximum gain. The output from V112 is mixed with the i-f signal from the fifth i-f amplifier stage merely by leakage within the shielded compartment containing BFO V112 and detector V111. BFO V112 is set into oscillation by the application of plate voltage via the BFO position of the function switch S102(B). The BFO output signal frequency provides a convenient reference frequency for the alignment of the i-f transformers T151 through T156.

e. PULSE GENERATOR AND IMPULSE CALIBRATOR STAGE. *(See figure 2–16.)*—The pulse generator

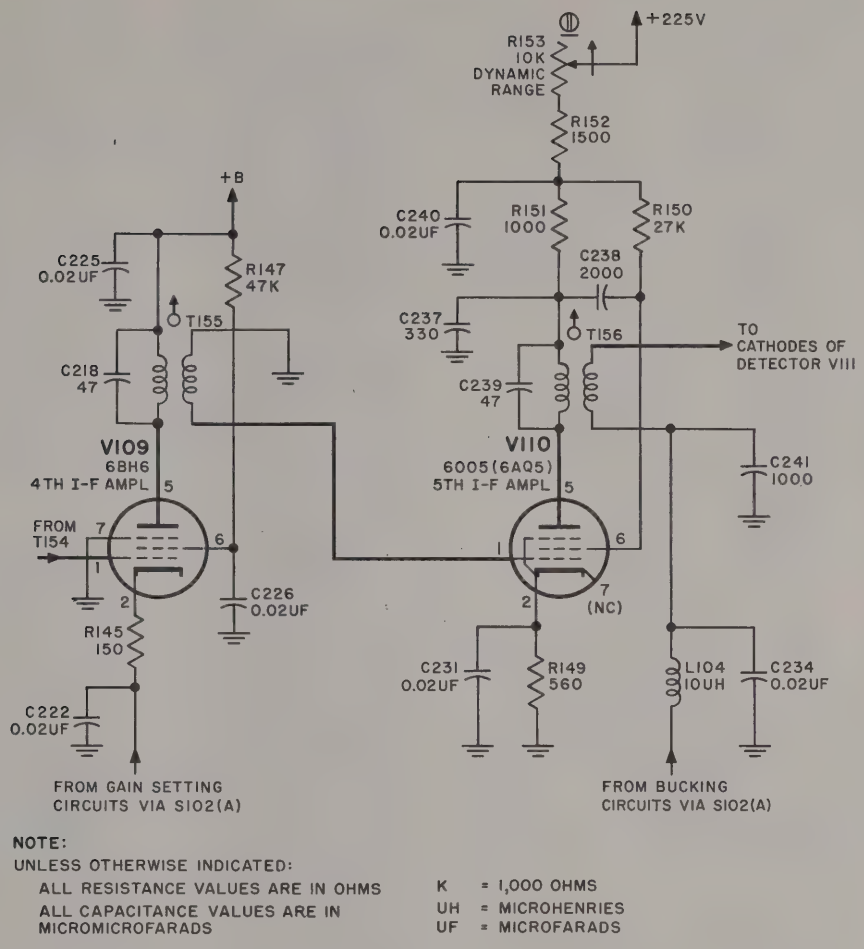


Figure 2—13. Fourth and Fifth I-f Amplifier Stages, Simplified Schematic Diagram

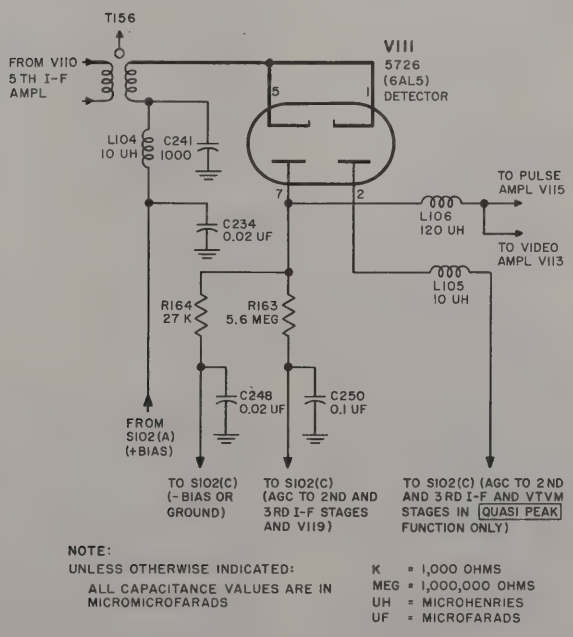

T156
FROM V110 5TH I-F AMPL
V111 5726 (6AL5) DETECTOR
L104 10 UH
C241 1000
TO PULSE AMPL V115
L106 120 UH
C234 0.02 UF
TO VIDEO AMPL V113
L105 10 UH
R164 27 K
R163 5.6 MEG
C248 0.02 UF
C250 0.1 UF
FROM S102(A) (+BIAS)
TO S102(C) (-BIAS OR GROUND)
TO S102(C) (AGC TO 2ND AND 3RD I-F STAGES AND V119)
TO S102(C) (AGC TO 2ND AND 3RD I-F AND VTVM STAGES IN QUASI PEAK FUNCTION ONLY)
NOTE:
UNLESS OTHERWISE INDICATED:
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
K = 1,000 OHMS
MEG = 1,000,000 OHMS
UH = MICROHENRIES
UF = MICROFARADS

Figure 2—14. Detector Stage, Simplified Schematic Diagram

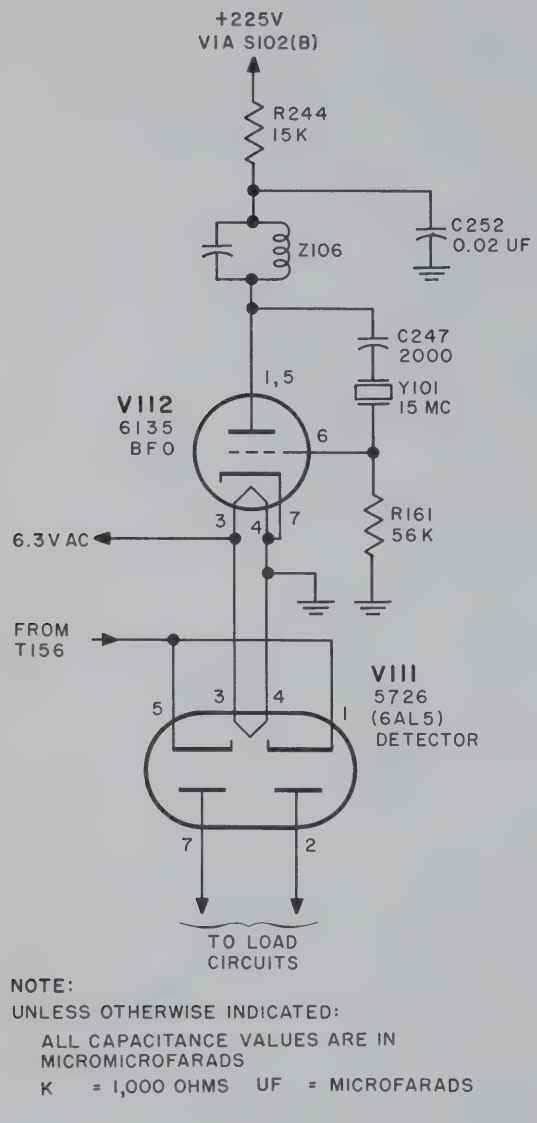


Figure 2–15. BFO (Beat Frequency Oscillator) Stage, Simplified Schematic Diagram

V121 and the impulse calibrator Z107 constitute a standard calibrating signal source contained within the equipment. The pulse generator V121 is essentially a free-running multivibrator operating at a low repetition rate (approximately 8 to 20 pulses per second). V121 is energized via S102(B) in the CAL position only. Capacitor C281 connected between the grid (pin 2) of V121 and the filament (pin 4) is used for the application of an initial disturbance to the grid to start action of the multivibrator. Pulse generator V121 drives the impulse calibrator Z107 by means of the coils of the latter which are connected in the cathode circuits of V121.

The impulse calibrator Z107 consists of a brass tube which contains an insulating sleeve. An iron slug with platinum contacts at either end moves axially between two mating platinum contacts within the insulating sleeve. The iron slug is actuated by the magnetic fields of two coils which are alternately energized by V121. The slug moves first by conduction of one half of V121 to the "charging" contact (energized from either +105 volts or −105 volts through R221). The slug becomes charged to that potential with respect to the grounded tubular shell. When the other half of V121 conducts, the slug is moved to the other end of its travel where it makes contact with a 10-ohm disc resistor through which the charge of the slug passes to ground. This creates a voltage pulse at the output terminal (connector) of Z107. This action is repeated for each cycle of operation of V121. The output pulses are delivered to J113 of switch S101 on the r-f attenuator assembly (via P106, cable W102, and P105) where they can be injected into the r-f stages. These pulses are of constant known amplitude and constitute the calibration signal for the equipment.

To prevent the transfer of metal at the platinum contacts which would occur if the polarity of the charging voltage were constant, the polarity is reversed each time the pulse generator and impulse calibrator are energized (i.e., each time the function switch S102 is set to the CAL position). This action is accomplished by S102(E) which is ratchet driven by the function switch shaft. One position of the switch connects the wafer section to the −105-volt supply; the next position of the switch connects the wafer section to +105 volts derived from a voltage divider consisting of resistors R228 and R229 connected between +225 volts and ground. Subsequent positions of the switch connect the wafer section alternately to −105 volts and +105 volts.

f. PULSE AMPLIFIER AND VISUAL NULL INDICATOR STAGES. *(See figure 2–17.)*—The pulse amplifier V115 is energized from the plate (pin 7) of detector V111 via r-f choke L106 and capacitor C266. These signals can be either pulses or sine waves since they are derived from the same source as the video and audio signals used for oscilloscope and aural indication, respectively. The visual null indication, however, is provided primarily for use in peak value calibration where pulse signals are of interest. Accordingly, the pulse amplifier V115 and its circuits provide higher gain for pulse signals than for sine wave signals. The negative pulses arriving from the detector are amplified in V115 and the positive output pulses (taken from the plate) of V115 are coupled through T157 to the grid (pin 2) of V116A.

Tube V116 is connected as a one-shot multivibrator trigger circuit. With no negative signal applied to the grid (pin 2), and with the proper bias applied to that grid from the PEAK SENS. control R191, tube V116A is normally conducting (see table 7–3). The other half of the tube V116B, however, does not conduct by virtue of the negative bias on the grid (pin 7) (see table 7–3). This negative bias is derived from the voltage divider formed by resistors R193, R196, and R197 connected between +225 volts and ground. The arrival of a sharp negative pulse at the grid (pin 2) of V116A drives this section to cutoff (non-conduction) and V116B to con-

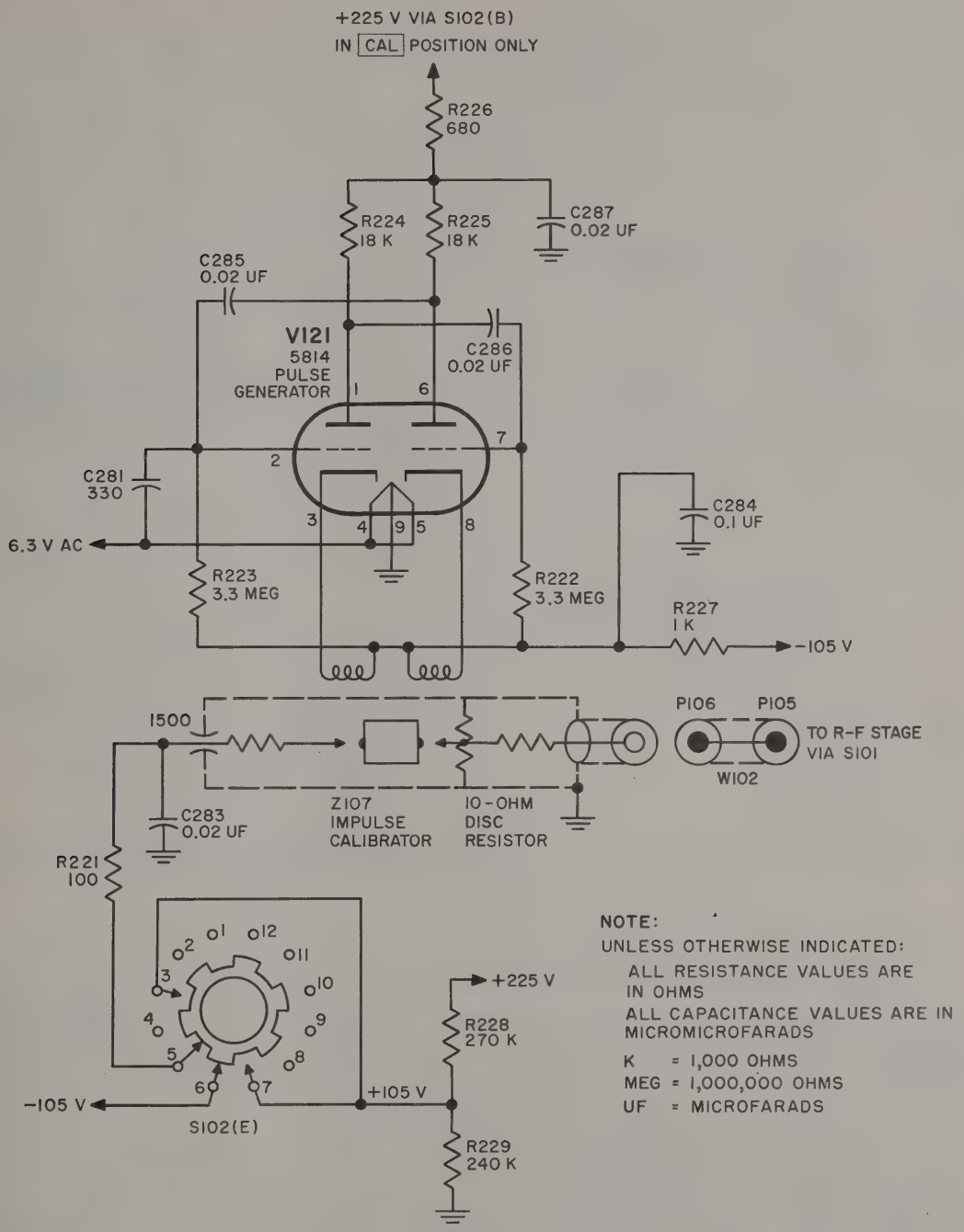


Figure 2–16. Impulse Generator and Calibrator Stage, Simplified Schematic Diagram

duction. This, at first, results in a decrease of potential in the plate circuit (pin 6) of V116B; then, as the circuit recovers, a positive potential, that is, a positive pulse of approximately 1/20-second duration, appears at pin 6 for each negative input pulse from V115. The output pulse is coupled to the succeeding pulse amplifier V117 via C274.

Pulse amplifier V117 is held at cutoff by a large negative bias (−105 volts) in the BFO, QUASI PEAK, and FIELD INTENSITY positions of the function switch S102(B). Visual null indication is not used in these positions. In the PEAK and CAL positions of S102(B), pulse amplifier V117 is provided with a suitable negative bias (approximately −10 volts) derived from the voltage divider formed by resistors R242 and R243 connected between −105 volts and ground. This negative bias prevents conduction of the tube until a positive pulse arrives from V116B. When the positive pulse from V116B is applied to the grid (pin 1) of V117, this tube conducts and allows current to flow through I102 for the duration of the pulse. The PEAK indicator lamp I102, therefore, flashes for each pulse output of V117.

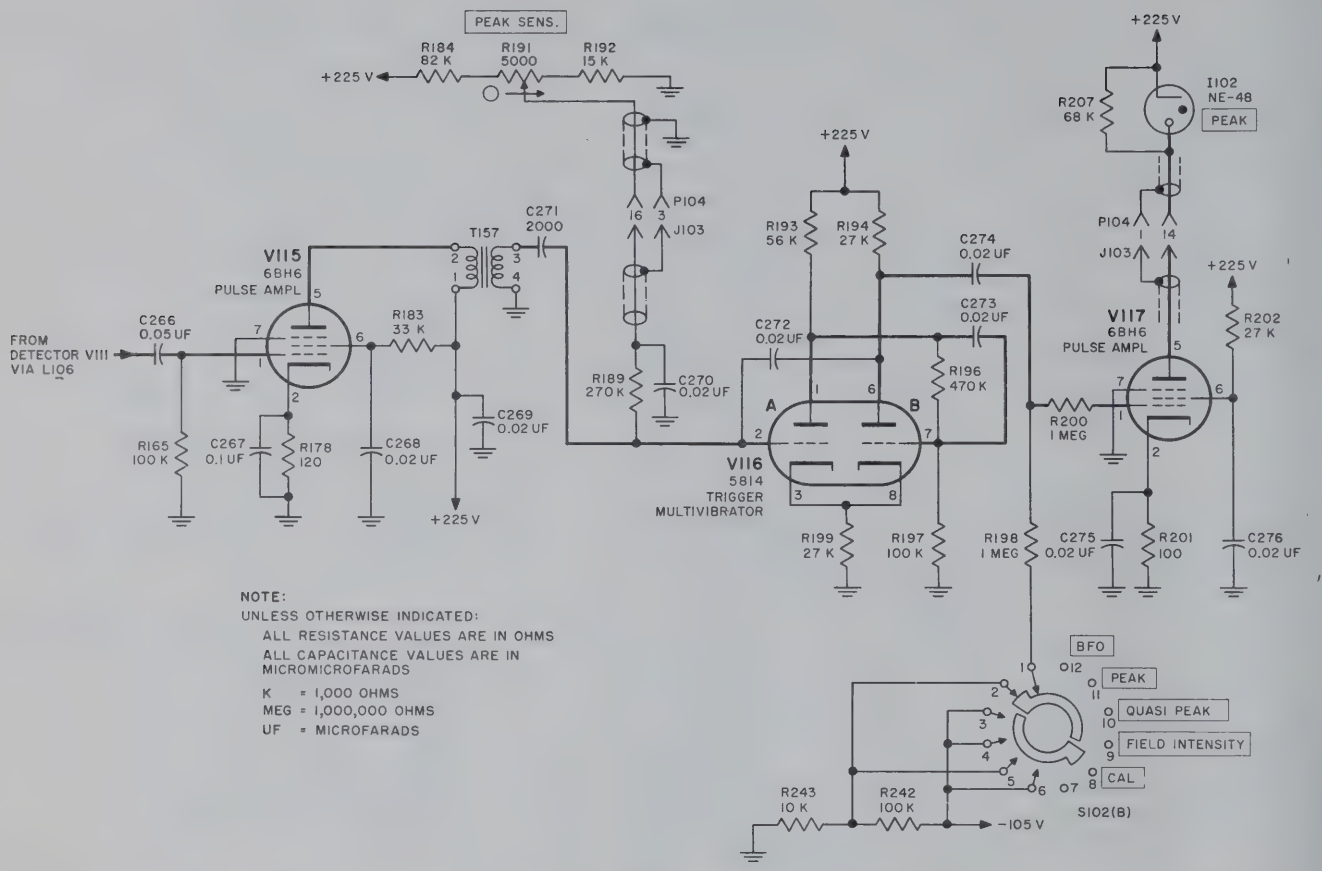


Figure 2–17. Pulse Amplifier and Visual Null Indicator Stages, Simplified Schematic Diagram

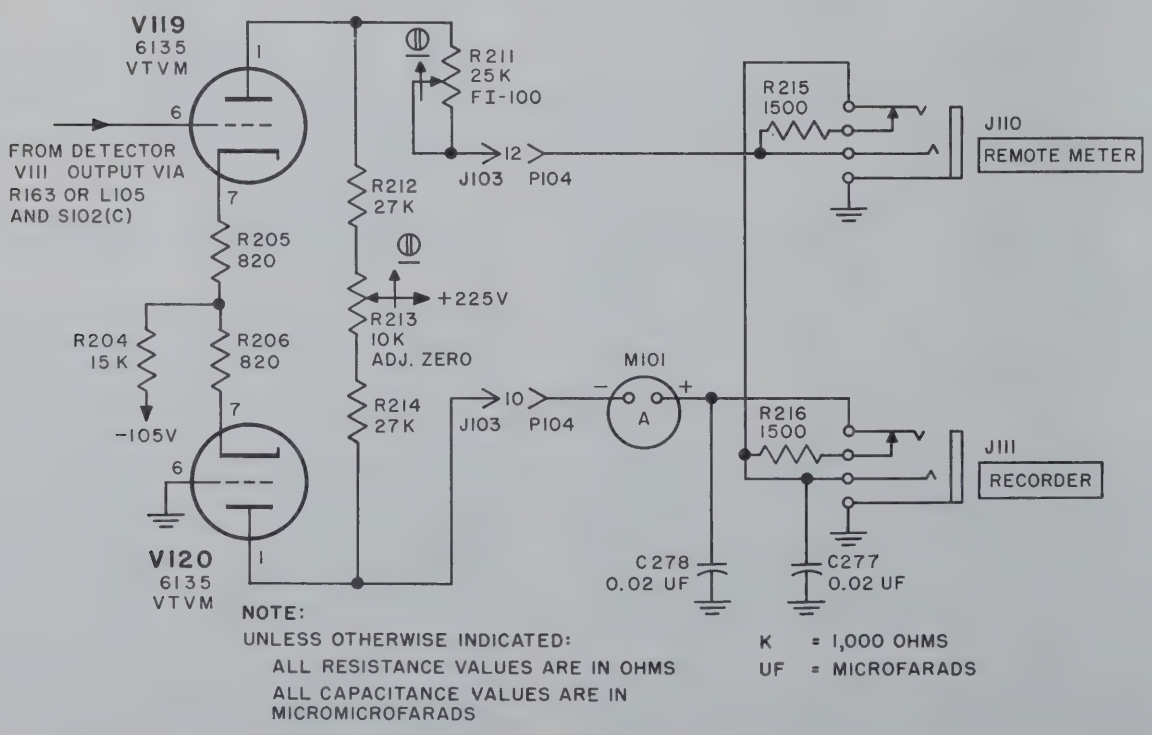


Figure 2–18. VTVM and Indicating Meter Stage, Simplified Schematic Diagram

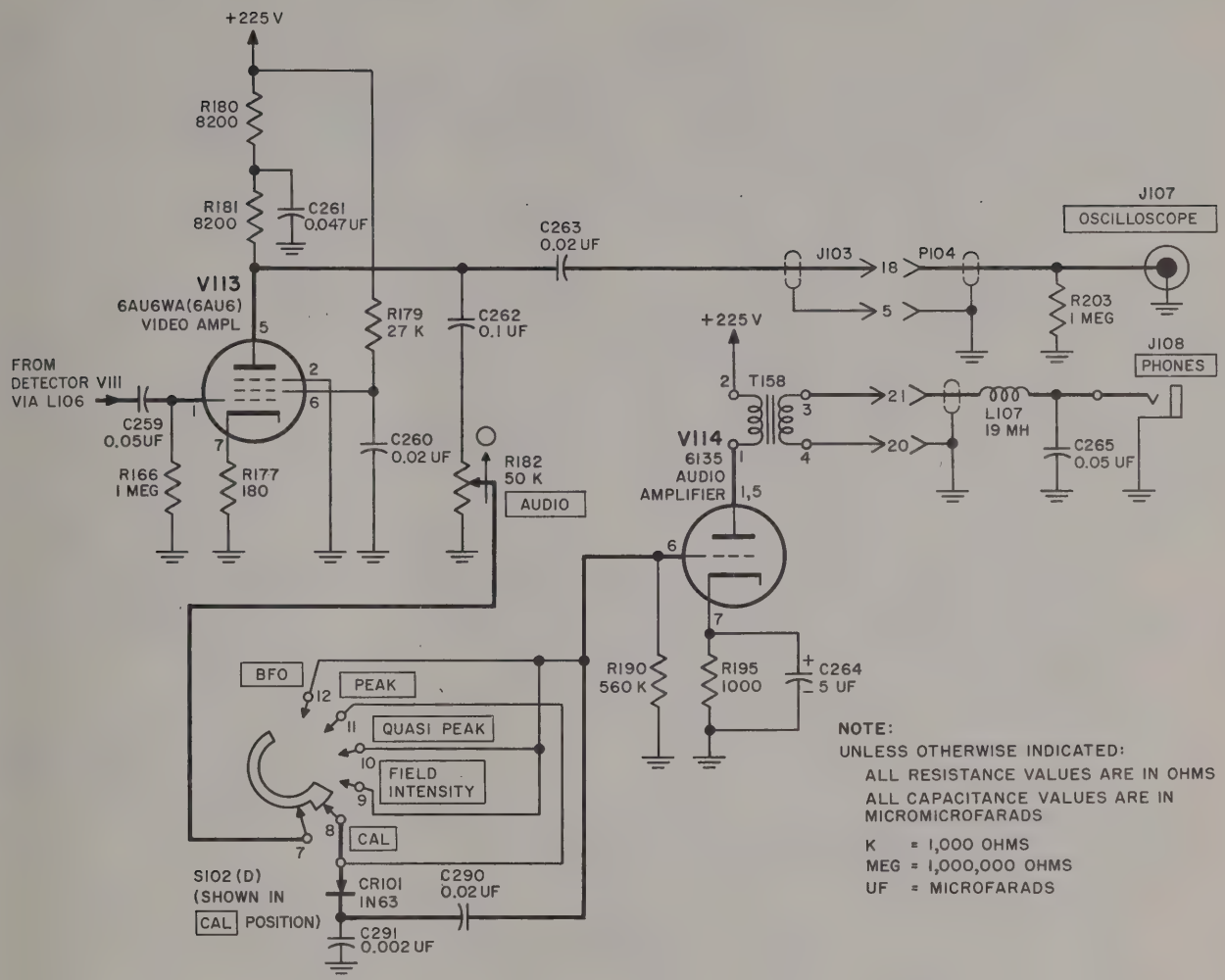


Figure 2–19. Video and Audio Amplifier Stages, Simplified Schematic Diagram

The trigger circuit of V116 is self-excited or free-running if a prescribed amount of bias is applied to the grid (pin 2) of V116A. In operation, with no signal applied to pin 2 of V116A, the PEAK SENS. control R191 is adjusted to the point where V116 is free-running (i.e., where the PEAK indicator lamp I102 starts to glow continuously). The PEAK SENS. control R191 is then adjusted slightly in the opposite direction to the point where the PEAK indicator lamp I102 just ceases to glow. This is the threshold point where a slight increase in negative bias will cause V116 to trigger and produce one flash of I102 for each pulse input.

g. VTVM AND INDICATING METER STAGE. *(See figure 2–18.)*—The vacuum tube voltmeter circuit consists of a balanced bridge circuit in which tubes V119 and V120 form two adjacent arms. The d-c voltage to be measured (from either of the two detector output circuits) is applied to the grid of V119 which upsets the balance of the bridge, causing the indicating meter M101 to deflect up-scale and indicate the magnitude of the unbalance. The use of the balanced bridge circuit counteracts the effects of supply voltage variation since supply variations will affect both tubes equally and the resulting change in meter indication will be negligible.

The Adj. Zero control R213 is used to adjust the voltage applied to the plates of V119 and V120 for balancing of the bridge. Balance is indicated by a zero indication of meter M101 with no signal input present. The FI-100 control R211 in series with meter M101 is a voltmeter sensitivity control for use in adjusting the meter full-scale deflection.

The REMOTE METER jack J110 and the RECORDER jack J111 provide connection facilities for a remote indicating meter and/or recording meter in series with meter M101. R-f pick-up by cables connected to these jacks is filtered by capacitors C277 and C278.

h. VIDEO AND AUDIO AMPLIFIER STAGES. *(See figure 2–19.)*—The video amplifier V113 amplifies the output of detector V111 (pin 7) to make the modulation envelope of the input r-f signal available for oscilloscope observation. The modulation envelope signal from V111

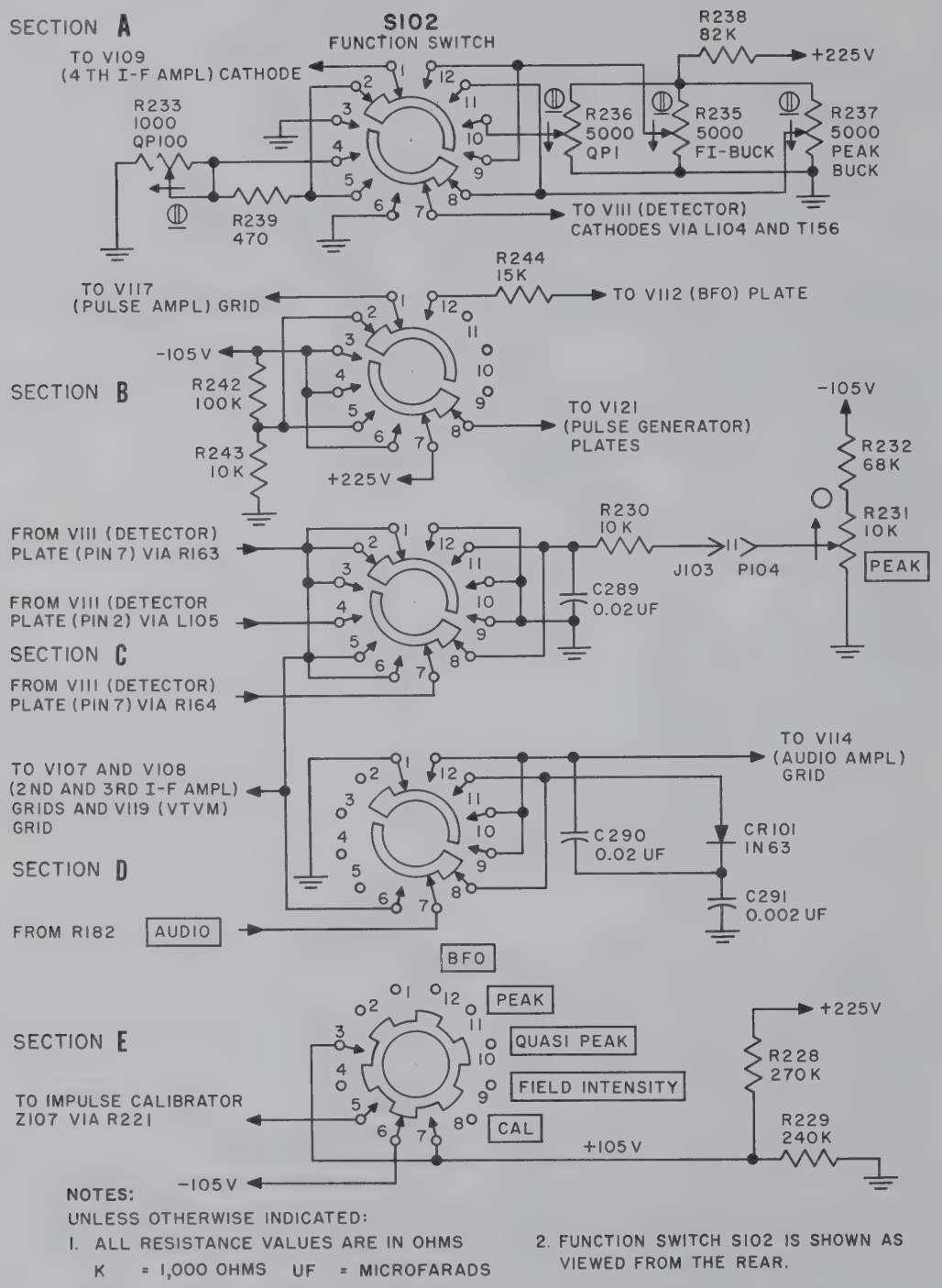


Figure 2–20. Function Switch S102, Simplified Schematic Diagram

is applied to the grid of video amplifier V113 via coupling capacitor C259. Video amplifier V113 has a wideband response so that the modulation envelope frequency components up to 100 kilocycles are passed. Low-frequency response is increased by the use of capacitor C261 in the plate circuit and the unbypassed resistor R177 in the cathode circuit. The video output is taken from the plate of V113 and delivered to the OSCILLOSCOPE jack J107 via coupling capacitor C263. The combination of C263 and the load resistor R203 has a time constant sufficiently high to insure good low-frequency performance in the oscilloscope output.

The audio signal is also taken from the plate of V113 and is coupled via C262 to the AUDIO control R182. From this point, the audio signal is applied through function switch S102(D) to the grid of audio amplifier

V114. After amplification by V114 the audio signal is coupled by transformer T158 to the PHONES jack J108 for delivery to a headset. The audio output can be adjusted by means of the AUDIO control R182. R-f choke coil L107 and r-f bypass capacitor C265 form an r-f filter to prevent entry of r-f pickup from the headset cable (connected to J108).

In some instances, the received input signal is a series of pulses so short in duration and/or with a repetition rate so low that the power output of the audio amplifier V114 is not sufficient to operate the headphones. Accordingly, a pulse stretcher circuit composed of CR101 and C291 is introduced in the grid circuit of V114 when the function switch S102(D) is in its PEAK or CAL position. The incoming positive pulse from video amplifier V113 passes through rectifier CR101 and charges C291. Because of the high resistance rectifier CR101 presents in the reverse direction, the charge of C291 leaks off slowly (with respect to the duration of the exciting pulse) through coupling capacitor C290 to the grid of audio amplifier V114. In this manner, the effective pulse length is increased and sufficient audio energy is produced to operate the headphones.

i. FUNCTION SWITCH, AGC, AND WEIGHTING CIRCUITS. *(See figures 2–20 through 2–25.)*–

Note

The term "weighting", as used in this text, refers to the time constant introduced in the detector and AGC circuits. This "weighting" effectivity determines the time versus voltage characteristics of the indication obtained.

(1) GENERAL.–The weighting circuits are selected by means of the function switch S102 and serve to weight the signal supplied to the indicating meter M101 properly for the three types of measurements performed by the equipment. These circuits and the performance features for each of the positions of the function switch S102 are discussed in the following subparagraphs. Simplified schematic diagrams are employed to illustrate these circuits (figures 2–21 through 2–25). In addition, a simplified schematic of the function switch alone is shown in figure 2–20.

(2) FIELD INTENSITY POSITION. *(See figure 2–21.)*–In the FIELD INTENSITY position of func-

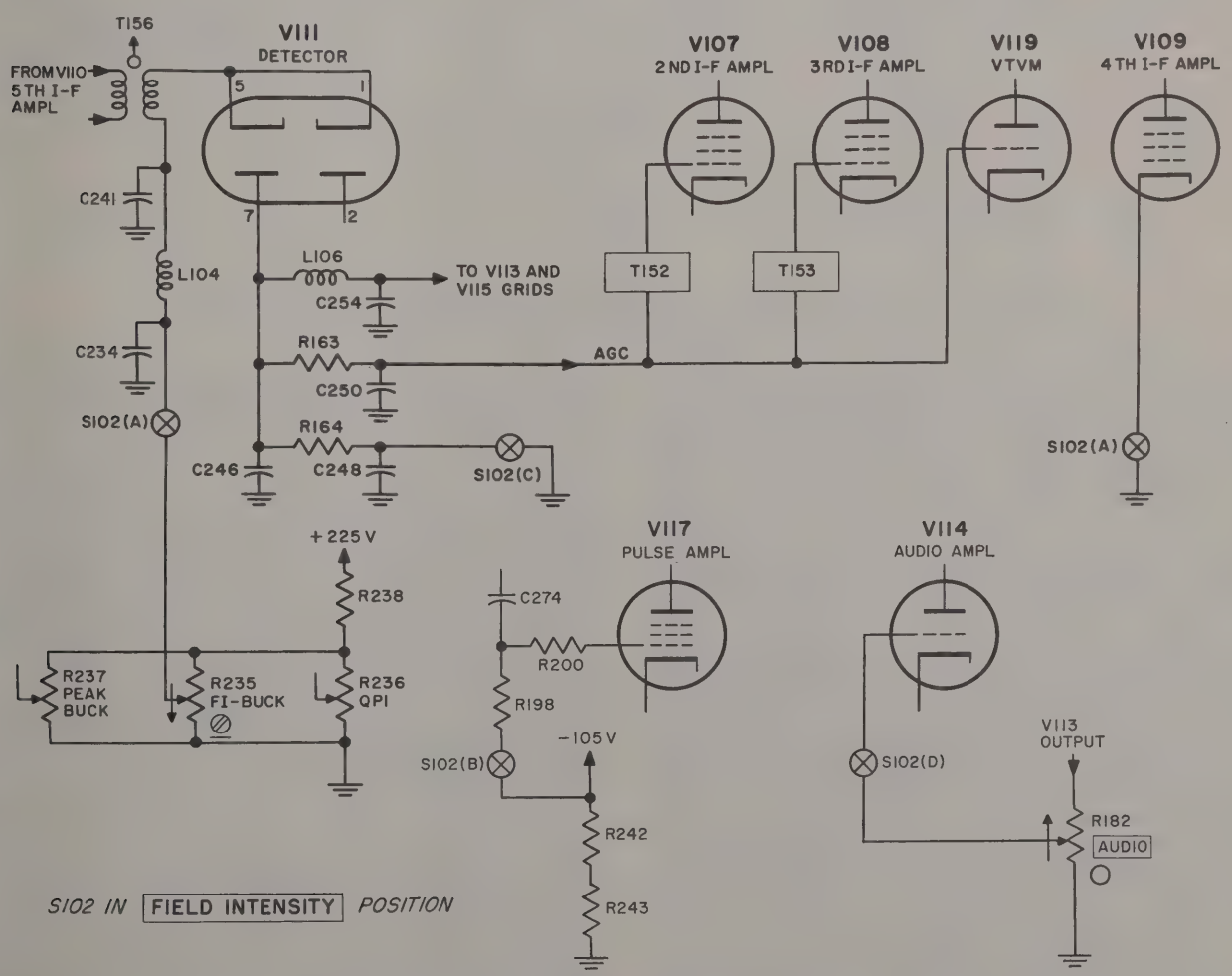


Figure 2–21. Function Switch in FIELD INTENSITY Position, Simplified Circuits

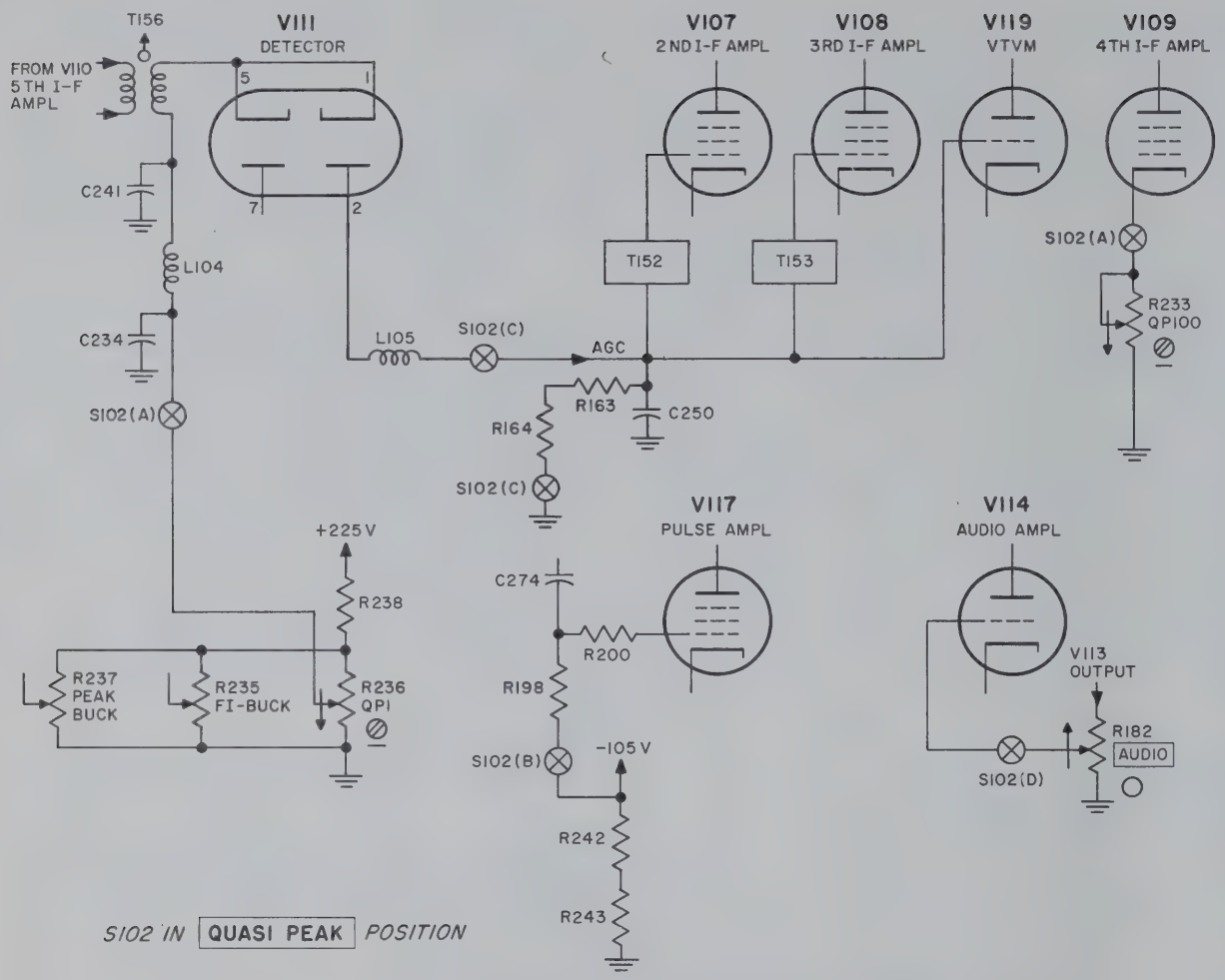


Figure 2–22. Function Switch in QUASI PEAK Position, Simplified Circuits

tion switch S102, only one half (pins 5 and 7) of detector V111 is used. Resistor R164 is the load resistor for this half of the detector V111. The video-audio signal is taken from the plate (pin 7) of V111 for application to pulse amplifier V115 (and the subsequent visual null indicator circuits) and to video amplifier V113 (and audio amplifier V114). Choke coil L106 and bypass capacitor C254 constitute an i-f filter to prevent appearance of an i-f signal component in the audio-video line.

A small self-induced voltage exists between the plate and cathode of V111. The effect is one of initial electron velocity in the diode caused by thermionic emission from the cathode. This voltage (diode self-bias potential) would also appear across load resistor R164 and in the VTVM and indicating meter circuit and would cause a small deflection on the indicating meter. To counteract this developed voltage, a small positive voltage, derived from variable resistor R235 FI-Buck, is applied through function switch S102(A) and the secondary of T156 to the cathode (pin 5) of V111. Variable resistor R235 FI-Buck is adjusted ideally to just cancel the self-bias potential of V111 (to just produce a zero reading on the indicating meter). Actually, the control is set to produce a very small deflection of the meter (approximately 1/16-inch deflection).

The detector output is also applied to the AGC circuit, R163 and C250, to produce the AGC signal which is applied to the grids of the second and third i-f amplifiers V107 and V108, respectively. The time constant of the AGC circuit, R163 and C250, is 600 milliseconds for charging and discharging. This relatively slow charge and discharge time filters out most of the modulation present in the detector output and produces a d-c signal whose magnitude is proportional to the average original carrier level. This same AGC (average carrier level) signal is also applied to the VTVM tube V119 to actuate indicating meter M101.

Switch S102(A) also connects the cathode of V109 (fourth i-f amplifier or gain compensating stage) to ground thereby removing additional cathode bias. Switch S102(B) applies a bias of −105 volts to the grid of pulse amplifier V117 to cut off this tube so that no visual indication can occur at PEAK indicator lamp I102. Switch S102(D) connects the output of AUDIO control

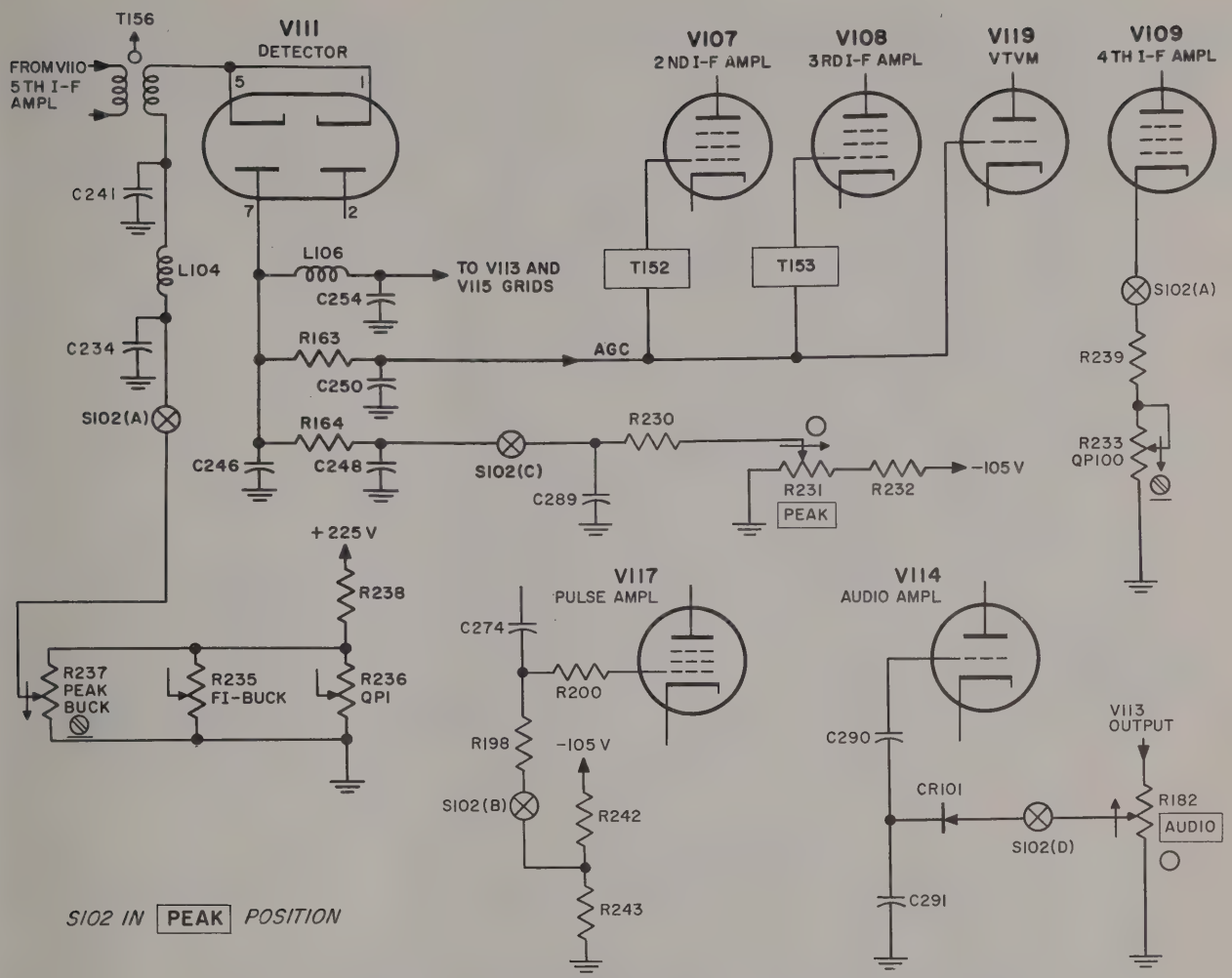


Figure 2–23. Function Switch in PEAK Position, Simplified Circuits

R182 directly to the grid of audio amplifier V114. Since pulse signals are not being studied in this position of the function switch, the pulse-stretching circuit is not necessary.

(3) QUASI PEAK POSITION. *(See figure 2–22.)* —In the QUASI PEAK position of function switch S102, both sections of detector V111 are in use. The video-audio signal is taken from the cathode (pin 7), as in the FIELD INTENSITY position, and the operation of these circuits is discussed in the preceding subparagraph.

In the QUASI PEAK position of S102, resistors R163 and R164 serve as the load resistors for the output from detector diode (pins 1 and 2). Resistors R163 and R164 and capacitor C250 constitute the weighting circuit. When detector V111 conducts, capacitor C250 charges up rapidly (one millisecond); when V111 ceases to conduct, capacitor C250 discharges slowly through R163 and R164, resulting in a long discharge time (600 milliseconds). Therefore, in the case of a received signal containing pulses occurring in rapid succession, the average voltage appearing across R163 and R164 will be near the peak value of the pulses. This voltage appearing across R163 and R164 is used as the AGC (and quasi-peak value) signal which is applied to the grids of the second and third i-f amplifier stages V107 and V108, and to the VTVM tube V119 to actuate indicating meter M101.

Because of this different mode of operation (different weighting circuit) and the requirement that, for an unmodulated r-f signal, the output indications be the same for both FIELD INTENSITY and QUASI PEAK operation, it is necessary that additional bias be applied to the fourth i-f amplifier stage V109. This is accomplished by means of adjustable resistor R233, QP 100, in the cathode circuit of V109 via S102(A).

The efficiency of detector V111 is different in QUASI PEAK operation from that in FIELD INTENSITY operation because of the difference in load resistors and, therefore, a different self-bias potential will be developed. Accordingly, a different positive bias is applied to the cathodes of V111 from R236, QP1, via S102(A).

As in FIELD INTENSITY operation, pulse amplifier

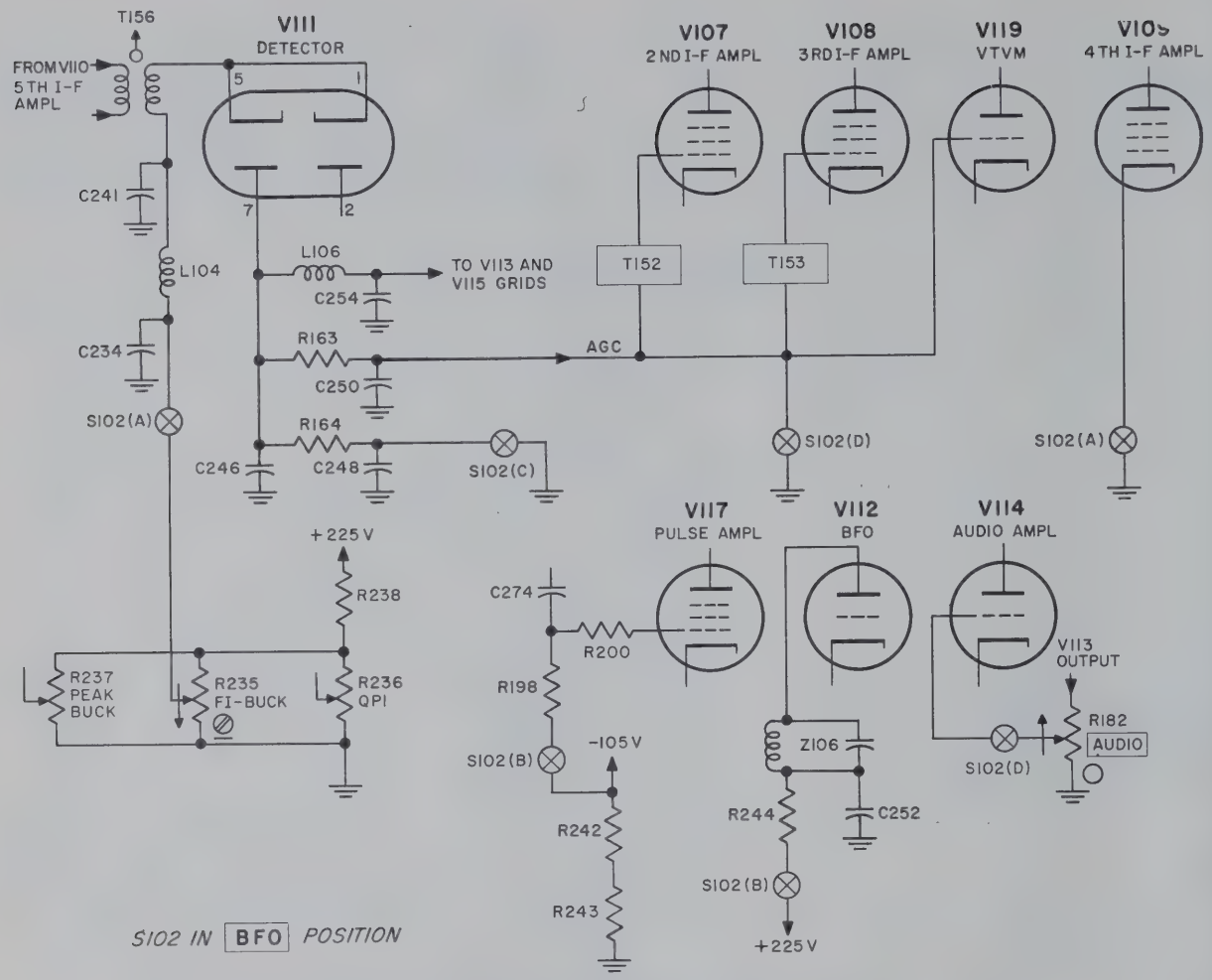


Figure 2–24. Function Switch in BFO Position, Simplified Circuits

V117 is held cut off by S102(B) and audio amplifier V114 is operated without the pulse-stretcher network by S102(D).

(4) PEAK POSITION. *(See figure 2–23.)*—In the PEAK position of the function switch S102, the peak values of pulse signals are to be measured. In this case, one diode (pins 5 and 7) of detector V111 is used. Resistor R164 is the load resistor for the diode. Resistor R164, however, is no longer connected to ground as in the FIELD INTENSITY case, but is connected through S102(C) and a filter network (composed of capacitor C289 and resistor R230) to an adjustable negative bias control R231 PEAK. This provides the standard "slide-back" measurement facility for the determination of peak values.

Function switch S102(A) permits application of a positive bias from variable resistor R237 Peak Buck to the detector V111. This is done to equalize the indicating meter reading for low signal levels (modulation of high repetition rate, i.e., 1000 volts) in the PEAK position with that obtained in the QUASI PEAK position of function switch S102. S102(A) also introduces an additional bias resistor in the cathode circuit of the fourth i-f amplifier V109 to modify the gain of this stage in accordance with the PEAK operation.

Switch S102(C) connects the AGC circuit, R163 and C250, to the grids of the second and third i-f amplifiers and to the VTVM stage. S102(B) removes the cutoff bias from pulse amplifier V117 and applies the appropriate operating bias for this tube so that pulse signal indications can be observed. Since the PEAK function of this equipment is employed with pulse signals, the pulse stretcher circuit, CR101 and C291, is inserted in the input circuit of audio amplifier V114 by switch S102(D).

In operation, the slide-back PEAK control R231 is first set to produce the maximum negative bias; the control is then adjusted in the reverse direction until the PEAK indicator lamp I102 just starts to flash or until the signal is just heard in the headphones. At this point, the signals applied to detector V111 are just beginning to overcome the bias supplied by R231. This bias voltage is then the measurement of the peak values and is effective at the plate (pin 7) of V111, the AGC bias circuit,

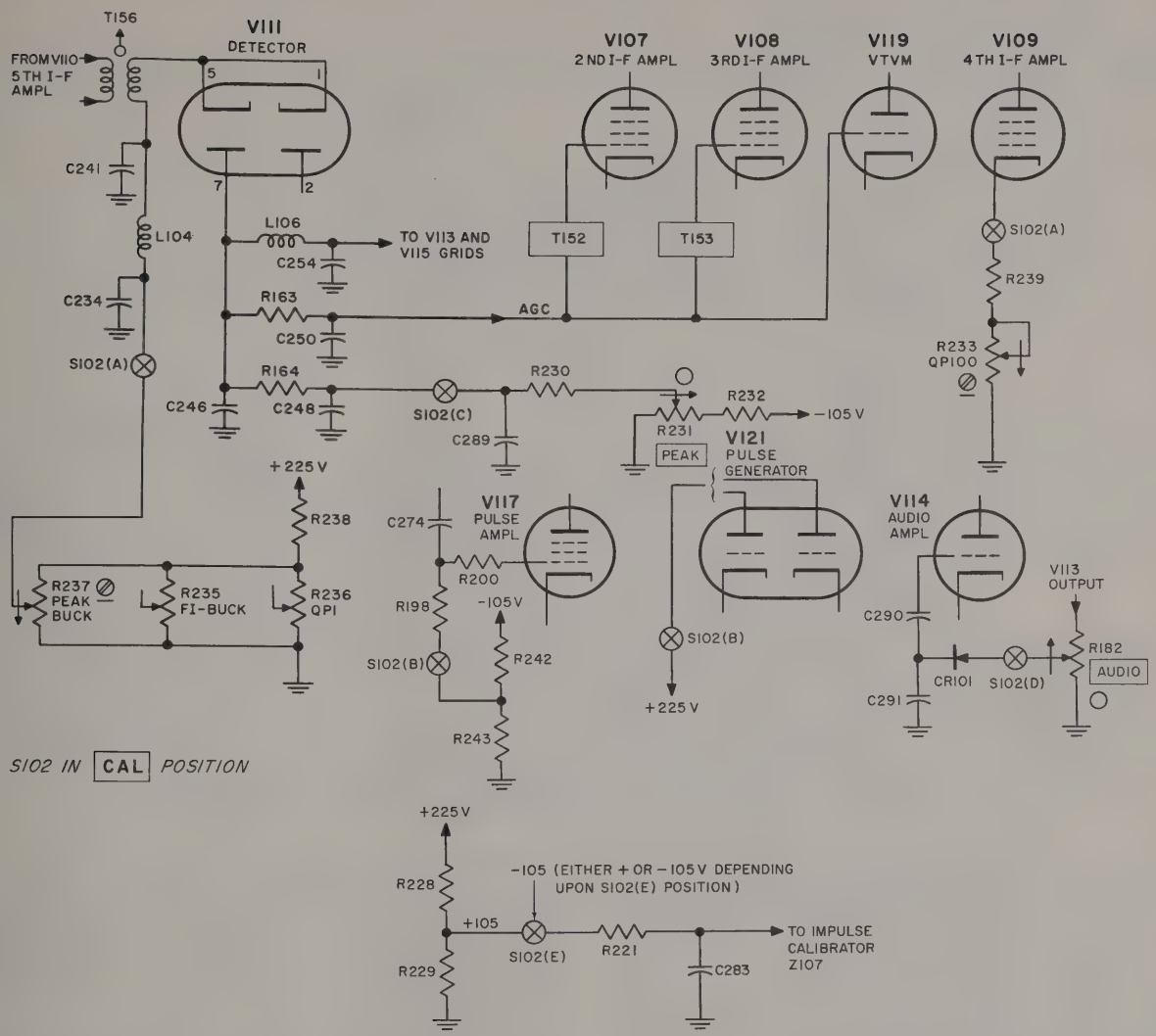


Figure 2–25. Function Switch in CAL Position, Simplified Circuits

and the signal supplied to the VTVM tube V119. For this latter reason, the reading on indicating meter M101 is the measurement of the peak values.

(5) BFO POSITION. *(See figure 2–24.)*—In the BFO position of the function switch S102, the circuit connections are the same as for the FIELD INTENSITY position except as indicated in the following.

The AGC circuit is grounded through S102(D). This causes the second and third i-f amplifier stages V107 and V108 to operate at maximum gain. The VTVM tube V109 is disabled to protect the indicating meter M101 from being driven off scale. The fourth i-f amplifier V109 is also permitted to operate at maximum gain since its cathode is connected to ground via S102(A). S102(B) allows the application of the +225-volt B+ supply to the plate of the BFO tube V112 for operation.

(6) CAL POSITION. *(See figure 2–25.)*—The CAL position of the function switch S102 provides the same circuit connections as in the PEAK position. This is done because the calibration of the equipment is accomplished by means of pulse signals from the impulse calibrator Z107. In addition to the PEAK position connections, the following connections are made.

Function switch S102(B) provides for the application of +225 volts to the plates of the pulse generator V121 so that the tube operates and actuates the impulse calibrator Z107.

Function switch S102(E) permits the application of either +105 volts or —105 volts to the impulse calibrator Z107 (see subparagraph 3.*e*).

4. DETAILED THEORY OF OPERATION, POWER SUPPLY PP-906/URM-47.

(See figure 2–26.)

Power Supply PP-906/URM-47 is designed to operate from a single phase source, 105 to 125 volts or 210 to 250 volts, and 50 to 1000 cps. The power supply provides regulated plate power of +225 volts (at 0.12 ampere), regulated bias supply of —105 volts, and filament power of 6.3 volts ac (at 4.35 amperes).

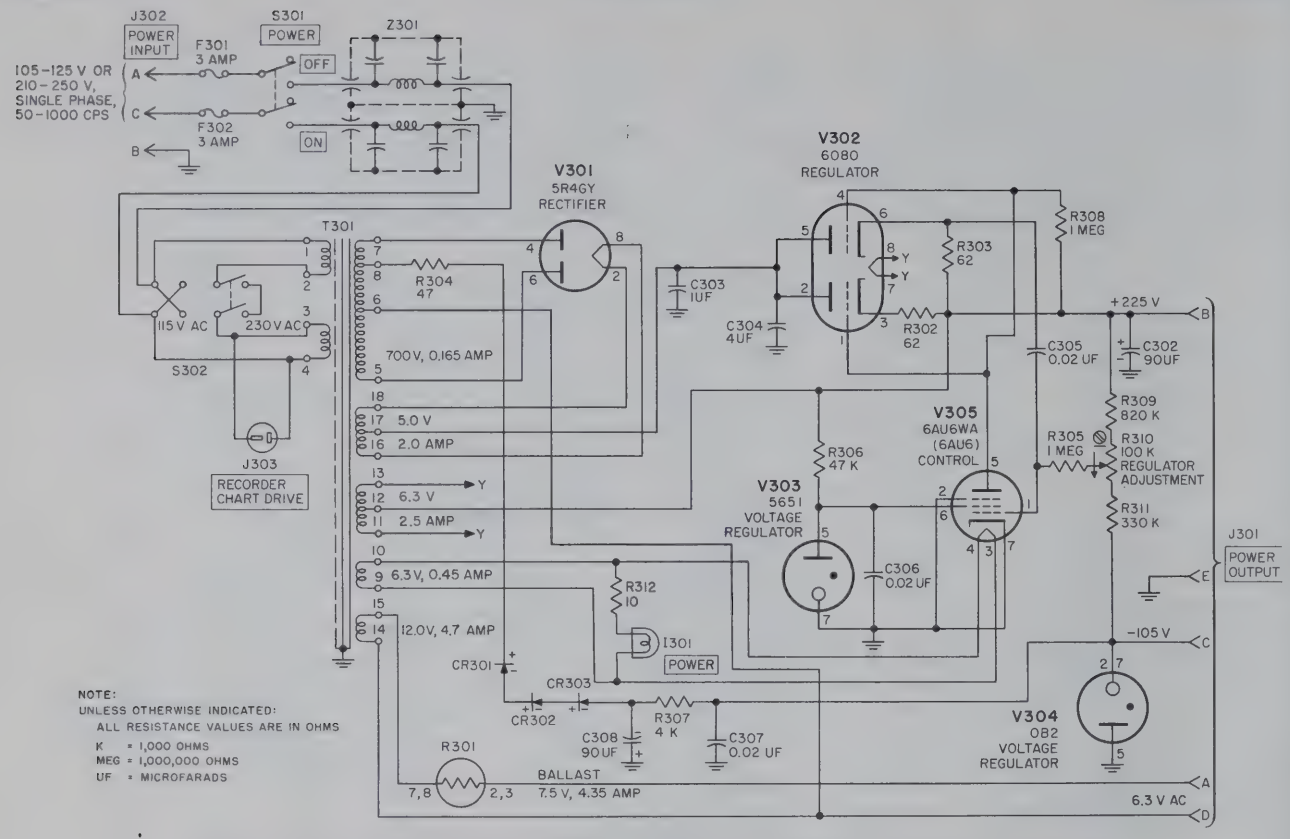


Figure 2–26. Power Supply PP-906/URM-47, Complete Schematic Diagram

The POWER switch S301 permits application of the primary power source from the POWER INPUT receptacle J302 to the input line filter Z301. Filter Z301 prevents line interference from entering the power supply circuits and RI-FI Meter and being recorded as interference. A DPDT toggle switch S302 located on the chassis provides for operation from a nominal 115 volts or 230 volts ac by connection, in parallel or series respectively, of the two primary windings of power transformer T301. A RECORDER CHART DRIVE receptacle J303 taps power from the filtered line supply to operate a recorder (for example, Milliammeter-Recorder RD-59/U), if employed.

The input power, obtained from the secondary winding (terminals 5 and 7) of transformer T301, is rectified by V301 and applied via the center tap (terminal 17) of the secondary winding (terminals 16 and 18) of T301 and to the plates of regulator V302. Regulator V302 and control tube V305 compensate for any fluctuation in the line and provide a regulated +225-volt plate supply. This is accomplished in the following manner.

Assume a positive fluctuation in the line supply. The conduction of regulator V302 increases and reflects the positive fluctuation at its cathode which causes a greater potential difference across voltage divider R309, R310, and R311. A portion of this increased potential is tapped off and applied through resistor R305 to the grid of control tube V305. The increased potential on the grid of V305 causes increased conduction of the tube. A larger voltage drop, therefore, occurs across the plate load resistor R308 and the grids of regulator V302 become more negative. This action decreases the conduction of regulator V302 compensating for the initial positive fluctuation.

Potentiometer R310 regulates the grid bias and, therefore, the output voltage of control tube V305. Voltage regulator V303 serves to maintain a constant screen grid voltage for V305 and also aids in regulating the +225-volt output. The regulated plate supply is obtained from the cathodes of V302 and applied to pin B of the POWER OUTPUT receptacle J301 for use by the RI-FI meter.

The —105-volt bias supply is obtained from terminal 8 of the secondary winding of transformer T301 and rectified by selenium rectifiers CR301, CR302, and CR303. The rectified output is filtered by capacitors C308 and C307 and maintained at a regulated —105 volts by voltage regulator V304.

Filament supply for regulator V302 (6.3 volts ac) is obtained from terminals 11 and 13 of T301; for control tube V305 (6.3 volts ac) from terminals 9 and 10 of T301. The POWER indicator lamp I301 is connected directly across the filament supply for V305. The filament supply (6.3 volts ac) for the RI-FI Meter is obtained from terminals 14 and 15 of T301 and applied through the current limiting ballast R301 to pins A and D of the POWER OUTPUT receptacle J301.

SECTION 3

INSTALLATION

1. SCOPE OF THIS SECTION.

Radio Interference Measuring Set AN/URM-47 is portable equipment and no provisions are made for permanent mounting. Procedures for setting up the equipment for operation are given in this section; actual operating procedures are given in Section 4.

2. UNPACKING THE EQUIPMENT.

(See figure 3–1.)

Unpack the equipment as directed in figure 3–1. Do not tear the waterproof barriers; open them carefully so that they can be used again. For the same reason, use a nail-puller or other suitable tool for removing nails in the shipping case cover so that the cover is not damaged. Upon removing the equipment from the shipping case, it is advisable to put the cellulose wadding and waterproof barriers back in the shipping case and retain the case for possible repacking and reshipping.

3. DIMENSIONAL DATA.

(See figures 3–2 through 3–5.)

Dimensional data given in the referenced illustrations can be used for estimating space requirements in the variety of operating locations afforded by Radio Interference Measuring Set AN/URM-47. These data are also useful in planning storage or transportation facilities for the equipment.

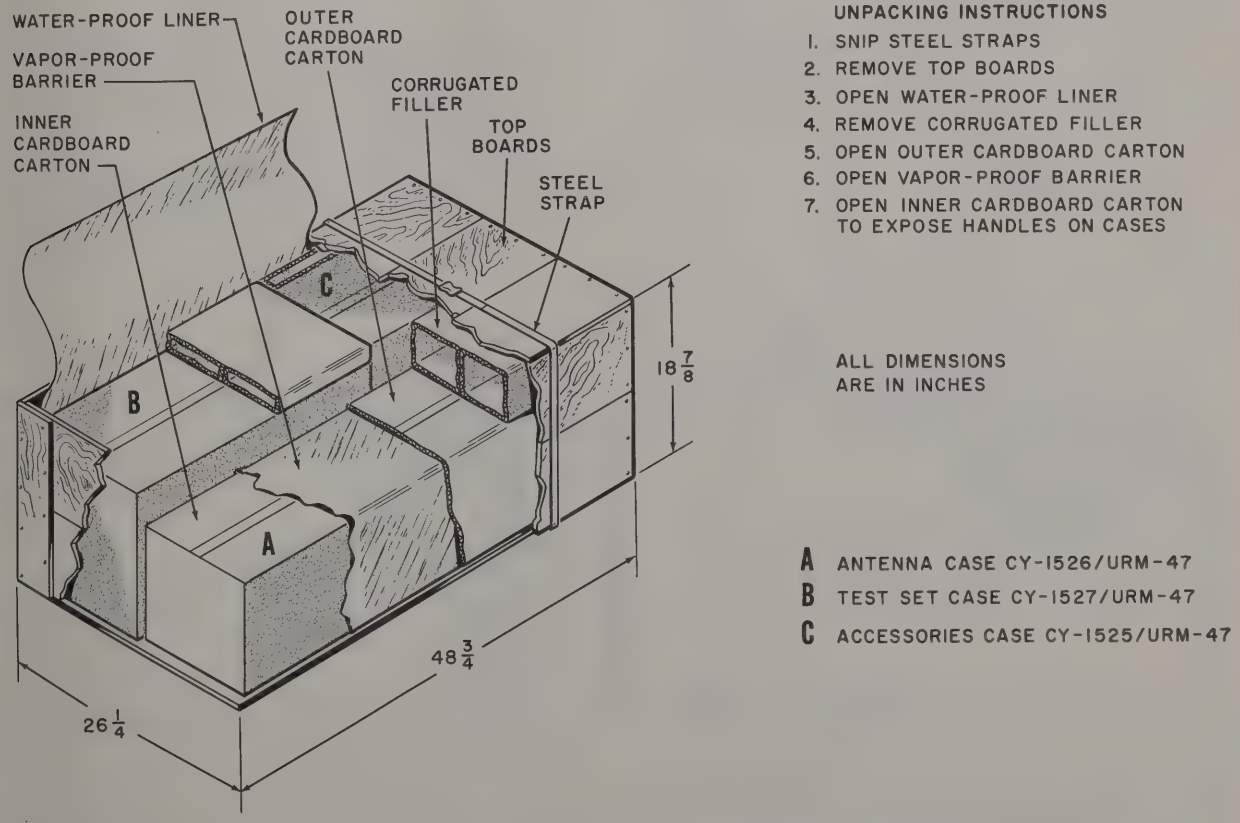


Figure 3–1. Radio Interference Measuring Set AN/URM-47, Unpacking Procedure

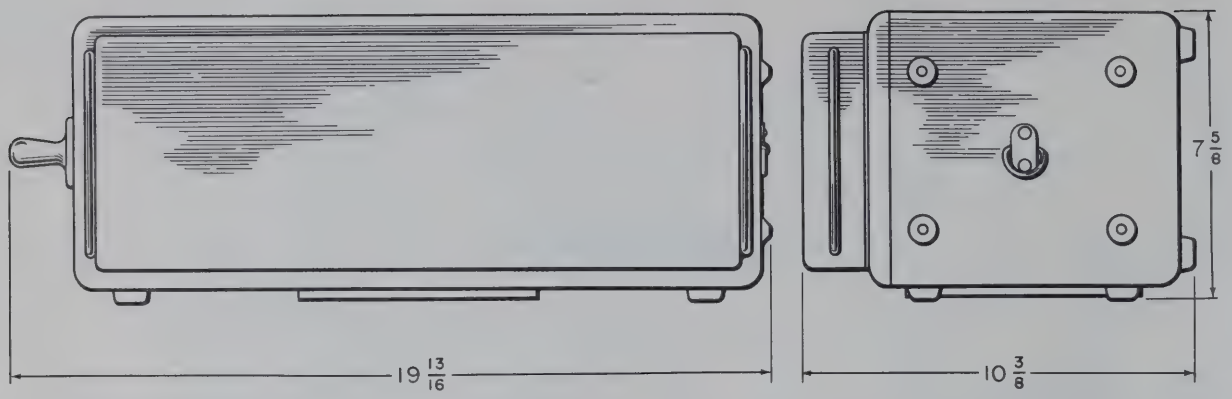


Figure 3–2. Radio Interference-Field Intensity Meter IM-88/URM-47, Outline Drawing

4. POWER SUPPLY REQUIREMENTS.

In general, the RI-FI Meter will be operated with an external power source connected to Power Supply PP-906/URM-47. The external power source must be rated at 105-125 or 210-250 volts ac, single phase, within the frequency range of 50 to 1000 cps. Power consumption of the equipment is 150 watts at 115 volts, 60 cps.

5. INITIAL EQUIPMENT SET-UP.

(See figure 3–6.)

a. GENERAL.–Radio Interference Measuring Set AN/URM-47 is radio interference and field intensity survey equipment suitable for operation in various situations. Instructions for setting up the equipment are given in paragraph 5. *b*, following; the optional use of accessories from other related test sets is given in paragraph 5.*c*.

b. REGULAR SET-UP.

Step 1. Open Test Set Case CY-1527/URM-47 and lift out the RI-FI Meter. Place the unit on a convenient bench or other flat surface with the front panel in a vertical plane. Remove the protective cover for access to the front panel. Remove Chart Set PT-188/URM-47 from the protective cover for reference during operation.

Step 2. Lift Power Supply PP-906/URM-47 out of Accessories Case CY-1525/URM-47 and place on the bench or flat surface. Remove the protective cover from the unit.

CAUTION

Operate the power supply with its front panel facing up because a thermal voltage regulator in the power supply unit must be in a vertical position during operation.

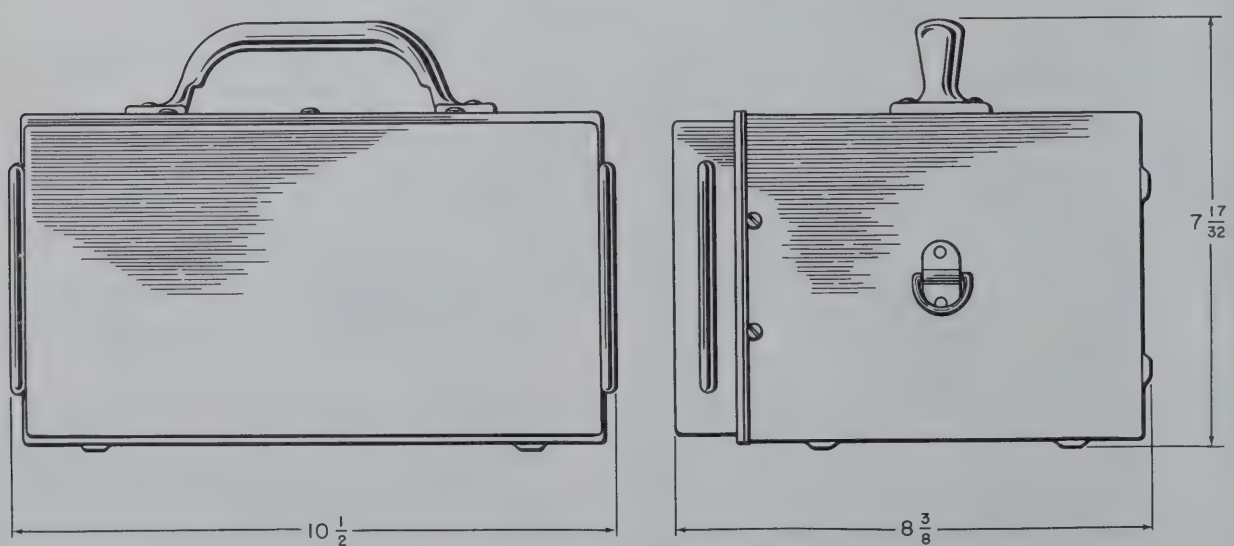


Figure 3–3. Power Supply PP-906/URM-47, Outline Drawing

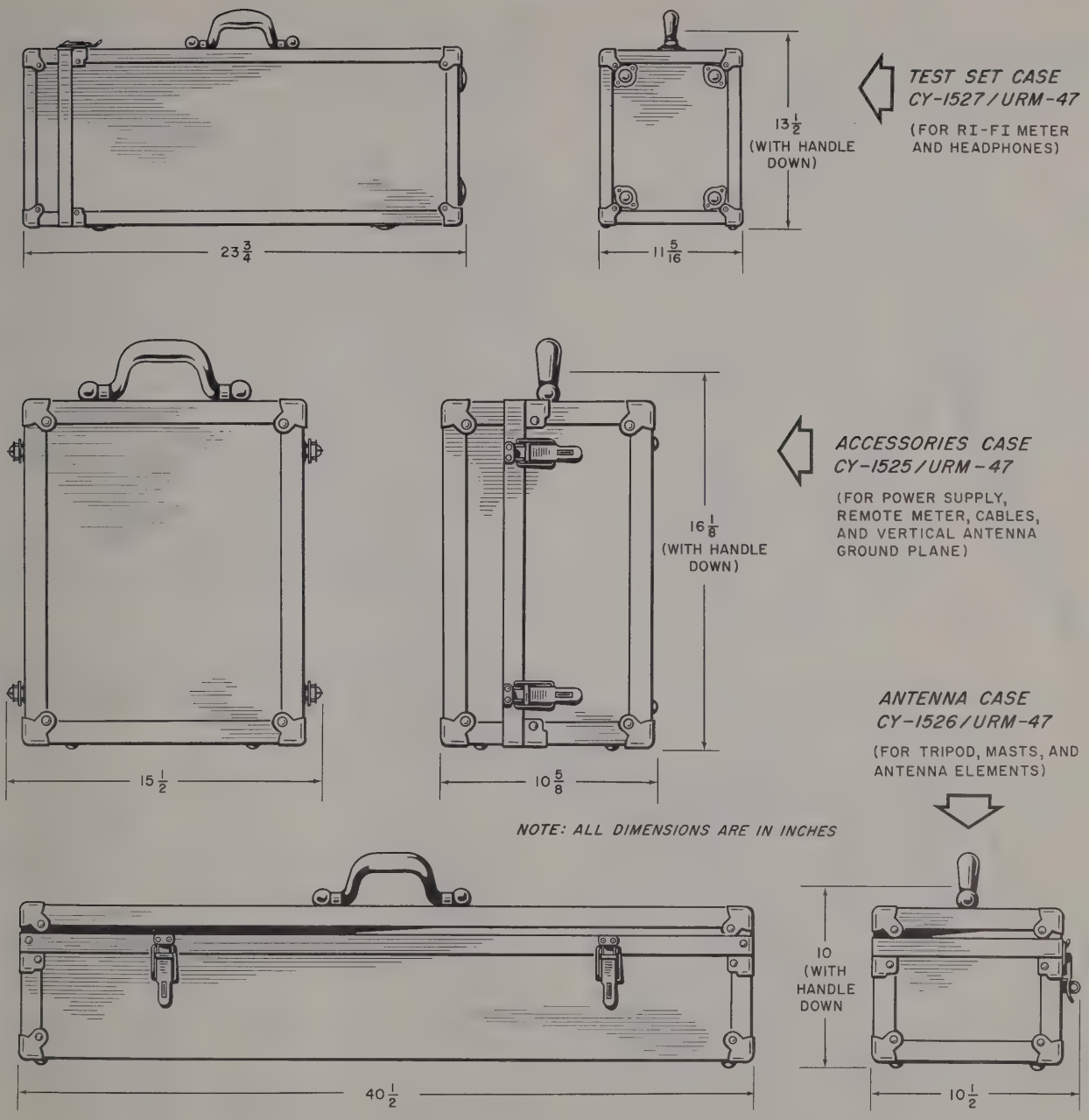


Figure 3–4. Carrying Cases, Outline Drawing

Step 3. Open the strap fasteners securing the cables in the accessory case.

Step 4. Remove the Power Cable Assembly CADV-62481 (10′ 0″) and connect between the POWER OUTPUT receptacle (J301) on the power supply and the POWER receptacle (J106) on the RI-FI Meter.

Step 5. Remove the a-c power cable Assembly CADV-62480 (6′ 0″) and connect to the POWER INPUT receptacle (J302) on the power supply. Do not connect the other end of cable to the external power source at this time. See subparagraph *d*, following.

Step 6. Remove the r-f transmission line Cable Assembly CG-92D/U (20′ 0″) and connect one end to the RF INPUT receptacle (J101) on the RI-FI Meter.

Note

In all types of measurements, Cable Assembly CG-92D/U (20′ 0″) must be connected between the RF INPUT receptacle and the antenna or probe. The Right-Angle Adapter UG-27B/U may or may not be used as desired for convenience.

Step 7. Connect the r-f probe cable, Radio Frequency Cable Assembly CG-1064/U (1′ 6″) to Cable Assembly CG-92D/U (20′ 0″) and the load (use the end with the alligator clips) to make conducted interference measurements on power lines up to 1000 volts ac or dc. The measurement in this case is made from each side of the line to ground and *not* across the line. The black

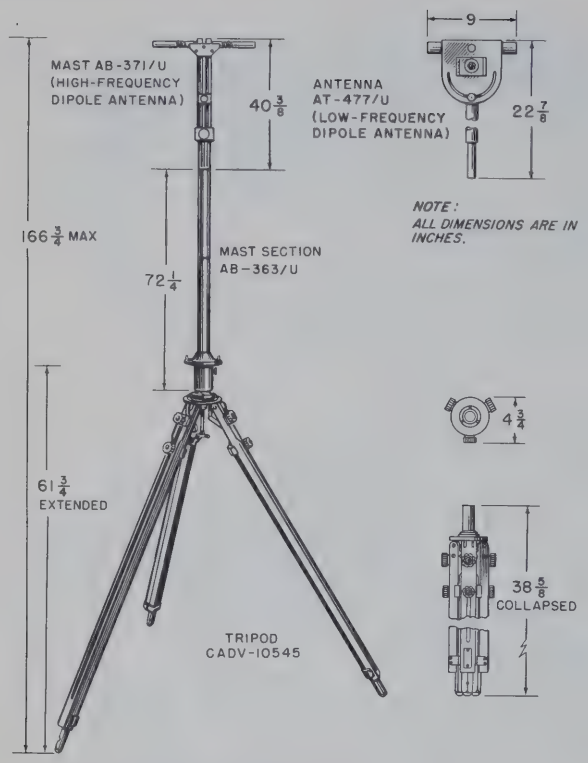


Figure 3–5. Dipole Antennas and Tripod, Outline Drawing

clip (shielded wire lead) must go to ground. When making conducted measurements, remove any other equipment ground connection to eliminate a "ground loop".

Step 8. Open Antenna Case CY-1526/URM-47 and assemble Mast Section AB-363/U and Tripod CADV-10545 for measurements using a dipole antenna. Loosen the upper knob on each leg, spread the legs as needed for adequate stability, and tighten the lock knobs. The extension portion of the tripod legs is removable, with one end fitted with a rubber foot for use on hard surfaces and the other end with a steel spike for use on soft surfaces. After loosening the lower lock knob on each leg, the extension portion can be lengthened or shortened as desired. Make sure the Azimuth Pointer Assembly is secured to one of the mast sections.

Step 9. The Azimuth Dial Assembly is inverted on the tripod head for stowing so that the sighting pins on the dial will be protected. Loosen the lock screw on the azimuth dial and slide it off the sleeve on the tripod head. Then, with the azimuth dial facing up, slip the assembly in place on the tripod head. The azimuth dial must be oriented to magnetic north before being locked to the tripod head.

Step 10. Remove either dipole antenna and all the antenna elements (seven pairs). Refer to Chart No. 3, figure 4–4, for the required antenna elements for the desired frequency. Attach the antenna elements to the dipole and connect Cable Assembly CG-92D/U (20′ 0″) (with or without the right-angle adapter) to the antenna dipole. Mount the antenna dipole at the top of the antenna mast section. Place the mast section temporarily into the Azimuth Dial Assembly until the azimuth dial has been oriented with magnetic north. (The antenna mast section may or may not be used, as desired.)

Step 11. If it is desired to use the loop antenna, Antenna AT-426/U, it can be hand-held or mounted on the tripod (with or without the antenna mast section). If it is to be hand-held, connect the r-f transmission line, Cable Assembly CG-92D/U (20′ 0″) directly to the loop antenna or through Antenna Base AB-374/URM-47 to the loop antenna. Antenna Base AB-374/URM-47 can be attached to the loop antenna by removing a knurled bayonet-fastened adapter from the loop and attaching the antenna base. The antenna base can be mounted on the tripod, if desired, with or without the mast section.

Step 12. The ground plane vertical Antenna Base AB-364/U is used without the tripod or mast section and is placed directly on the ground. Twenty-six copper wires for this antenna base need only be used when the soil is dry. The antenna elements are attached to the base and extend vertically upwards. Connect the r-f transmission line, Cable Assembly CG-92D/U (20′ 0″), to the antenna base.

c. OPTIONAL SET-UP.—Certain accessories supplied with related equipment can be used with Radio Interference Measuring Set AN/URM-47 to facilitate field operations as follows:

ACCESSORY	PARENT TEST SET	OPTIONAL USE
Observer Compass MARK 1 MOD 0	AN/URM-6	Orient dipole antenna to magnetic north.
Special Purpose Cable Assembly CG-572/U (20′ 0″)	AN/URM-6 AN/PRM-1	Headphone extension cable.
*Ammeter ME-31/U	AN/URM-6	Remote meter indication at dipole antenna location.
Special Purpose Cable Assembly CG-571/U (20′ 0″)	AN/URM-6 AN/PRM-1	Cable to remote meter.
**Milliammeter-Recorder RD-59/U	AN/URM-6	Make graphic recordings.
Special Purpose Cable Assembly CG-571/U (6′ 0″)	AN/URM-6	Cable to milliammeter-recorder.
Tripod MT-674/U	AN/URM-6	To mount the RI-FI Meter on a tripod.

*Not precisely identical to indicating meter in Radio Interference-Field Intensity Meter IM-88/URM-47.

**Calibrated rule supplied with this unit is not suitable for Radio Interference-Field Intensity Meter IM-88/URM-47.

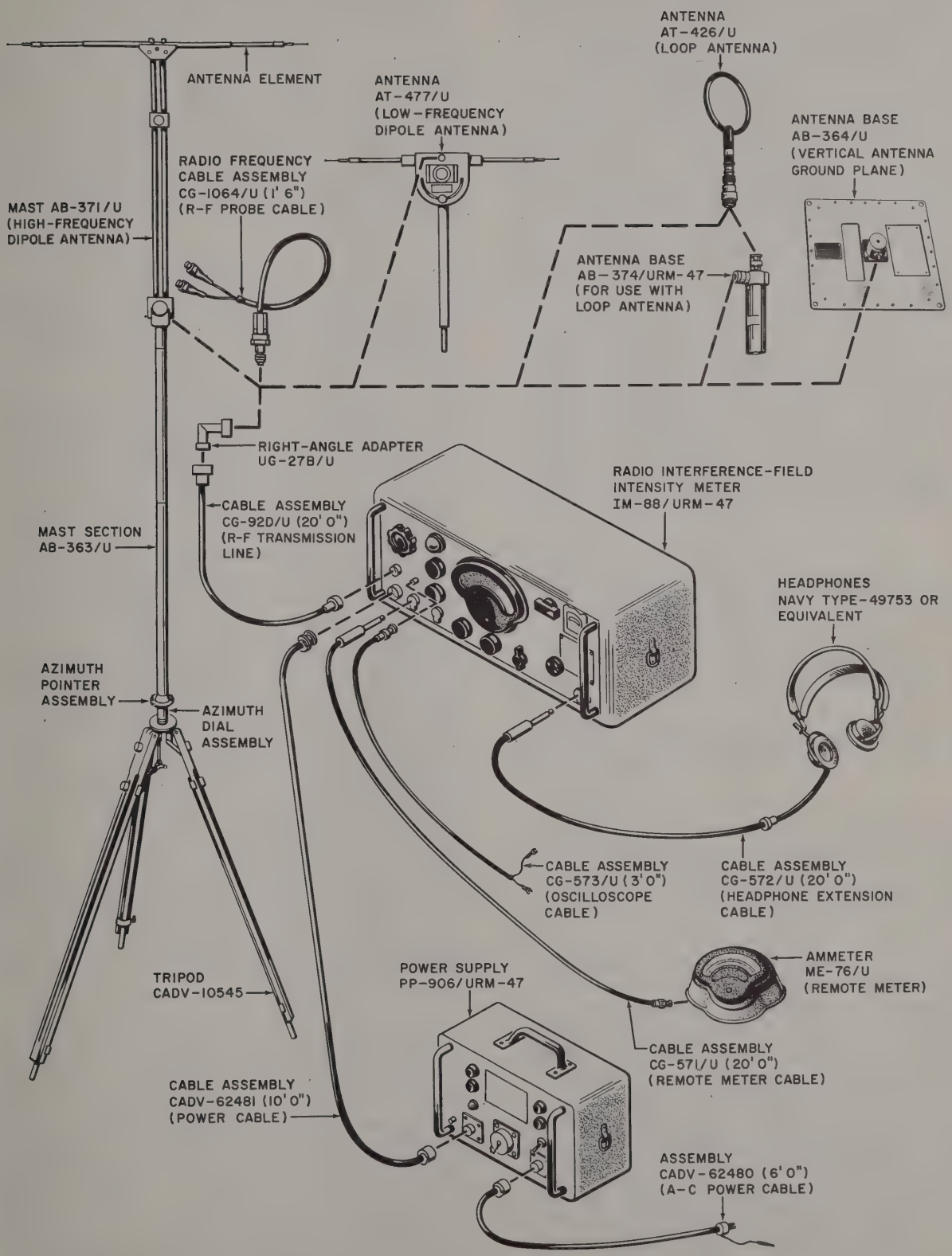

ANTENNA ELEMENT
ANTENNA AT-477/U (LOW-FREQUENCY DIPOLE ANTENNA)
ANTENNA AT-426/U (LOOP ANTENNA)
ANTENNA BASE AB-364/U (VERTICAL ANTENNA GROUND PLANE)
RADIO FREQUENCY CABLE ASSEMBLY CG-1064/U (1' 6") (R-F PROBE CABLE)
MAST AB-371/U (HIGH-FREQUENCY DIPOLE ANTENNA)
ANTENNA BASE AB-374/URM-47 (FOR USE WITH LOOP ANTENNA)
RIGHT-ANGLE ADAPTER UG-27B/U
CABLE ASSEMBLY CG-92D/U (20' 0") (R-F TRANSMISSION LINE)
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47
MAST SECTION AB-363/U
HEADPHONES NAVY TYPE-49753 OR EQUIVALENT
AZIMUTH POINTER ASSEMBLY
AZIMUTH DIAL ASSEMBLY
CABLE ASSEMBLY CG-573/U (3' 0") (OSCILLOSCOPE CABLE)
CABLE ASSEMBLY CG-572/U (20' 0") (HEADPHONE EXTENSION CABLE)
AMMETER ME-76/U (REMOTE METER)
TRIPOD CADV-10545
POWER SUPPLY PP-906/URM-47
CABLE ASSEMBLY CG-571/U (20' 0") (REMOTE METER CABLE)
CABLE ASSEMBLY CADV-62481 (10' 0") (POWER CABLE)
ASSEMBLY CADV-62480 (6' 0") (A-C POWER CABLE)

Figure 3–6. Radio Interference Measuring Set AN/URM-47, Connection Diagram

The use of these units is described briefly here: A mounting plate is fitted to the bottom of Radio Interference-Field Intensity Meter IM-88/URM-47 similar to that on the bottom of Radio Interference-Field Intensity Meter IM-36/URM-6 so that the RI-FI Meter can be mounted on Tripod MT-674/U, if desired.

Topography of the survey site might require the dipole antenna location be approximately 20 feet from the location of the RI-FI Meter. In this case, it would be convenient to use the remote Ammeter ME-31/U at the antenna, when turning the antenna to obtain a null indication and magnetic bearing. Connect the remote meter to the REMOTE METER receptacle on the RI-FI Meter, using the remote meter Cable Assembly CG-571/U (20′ 0″). Since Ammeter ME-31/U is not identical to the panel mounted meter, the remote meter readings will not be the same as those of the panel mounted meter. Construct a conversion chart to convert Ammeter ME-31/U readings using the RI-FI Meter as reference. Using the PEAK function of the equipment, adjust the PEAK control to obtain indicator meter readings at the main calibration points on the meter scale. Plot the remote meter readings on the horizontal axis and the RI-FI Meter readings on the vertical axis. Draw a smooth curve through the plotted points.

Note

Radio Interference Measuring Set AN/URM-47 contains a remote meter, Ammeter ME-76/U, and its Cable Assembly CG-571/U (20′ 0″) which can be used in the same manner as the Ammeter ME-31/U.

Headphone extension Cable Assembly CG-572/U (20′ 0″) permits use of headphones at the antenna location.

Note

Radio Interference Measuring Set AN/URM-47 also contains Cable Assembly CG-572/U (20′ 0″) for use with the headphones.

It might also be convenient to use Milliammeter-Recorder RD-59/U to make graphic recordings. In this case, a source of 115 volts ac, 60 cps must be available for the synchronous motor in the recorder. The recordings will be approximations only, in view of the fact that the chart ruler supplied with the recorder is not calibrated for use with the RI-FI Meter. A new chart rule can be calibrated however, by using the RI-FI Meter scale as reference. Connect the recorder to the RECORDER CHART DRIVE receptacle on the RI-FI Meter by means of Cable Assembly CG-571/U (6′ 0″). Using the PEAK function of the RI-FI Meter, adjust the PEAK control to obtain indicating meter readings at the main calibration points on the meter scale. Place a strip of clear plastic across the recorder chart and mark the plastic strip at the points obtained from the chart record.

Note

Radio Interference Measuring Set AN/URM-47 does not contain the Special Purpose Cable Assembly CG-571/U (6′ 0″).

In the event of power cable failure in the field, note that the power cables for connection between the RI-FI Meter units and power supply units are identical in Radio Test Sets AN/URM-6, AN/PRM-1, and AN/URM-17, and Radio Interference Measuring Set AN/URM-47. The power cables for connection between the power supply unit and the external power source are also identical.

The tripod, azimuth dial assembly, and azimuth dial pointer supplied with Radio Interference Measuring Set AN/URM-47 are identical to the units supplied with Noise-Field Intensity Meter TS-587/U and Radio Test Set AN/URM-17.

d. EXTERNAL POWER SOURCE CONNECTION. —The external power source may be either 105-125 or 210-250 volts ac, 50-1000 cps. Connect the plug on the end of power cable Assembly CADV-62480 (6′ 0″) to the external source.

To accommodate either voltage source, the power switch S302 located on the chassis of Power Supply PP-906/URM-47 must be set to the appropriate high- or low-voltage position. The "in-use" position of this switch should be indicated on the front panel by means of a metal reminder tag located to the right of the POWER INPUT receptacle (see figure 4—2). This metal tag covers one half of the front panel legend 115 V 230. Check that the exposed portion of this panel marking agrees with the power source voltage to be used. If the voltage source to be used differs from that indicated on the front panel, the position of switch S302 must be changed. Remove ten screws from the power supply case and slide out the chassis. Change the position of switch S302 to correspond with the external voltage employed. Replace the chassis within the case and replace the ten screws previously removed. Loosen the screw that fastens the metal reminder tag on the front panel and rotate the tag 180 degrees to correspond with the voltage source used. Tighten the tag screw.

Connect a good ground to the GROUND binding post on the power supply front panel or to the third conductor (from pin B) of a-c power cable Assembly CADV-62480 (6′ 0″). Only one ground point should be used because grounding more than one creates a loop in conjunction with the interconnecting cable. To avoid this loop, make sure the case of any ungrounded unit is not inadvertently grounded by placing it on the earth or on a metal surface. This ground connection should be removed when making a conducted measurement with Radio Frequency Cable Assembly CG-1064/U (1′ 6″) since a single ground at the source of measurement is then derived.

6. INITIAL ADJUSTMENTS.

a. ELECTRICAL ADJUSTMENTS. – All internal alignment and calibration adjustments on Radio Interference Measuring Set AN/URM-47 have been made at the factory and no further adjustment is required in the field prior to operation.

Note

Refer to figures 4–1 and 4–2 for front panel controls.

It is recommended that the following operational checks be made when the equipment has been set up for operation:

Step 1. Check the mechanical zero of the front panel indicating meter. If the pointer is off zero, correct as necessary by means of the screw located on the meter cover. This must be done with power supply POWER switch S301 in the OFF position.

Step 2. Turn the POWER switch S301 to ON. The power supply pilot light I301 and the dial light I101 of the RI-FI Meter should light. The equipment is ready for operation after a few minutes warm-up.

Step 3. After a warm-up period of 15 minutes, set the function switch to the BFO position. The meter output indication should be at zero. If different from zero by more than 1/16-inch deflection, an adjustment must be made. Leaving the function switch in the BFO position, remove the RI-FI Meter chassis from its case and adjust the Adj. Zero control R213 for a zero meter indication. (The Adj. Zero control R213 is a locking type potentiometer; first unlock, use screwdriver for adjustment, then lock again.) Slide chassis back into its case.

Step 4. Set the function switch to the FIELD INTENSITY position. Set attenuator to the $X10^2$ position. (The attenuator can be rotated by first pulling the knob, turning to correct position, and then pushing the knob back.) Set the CALIBRATE control R128 fully counterclockwise. With no r-f input signal applied to the RF INPUT receptacle J101, the indicating meter M101 should show a slight deflection above zero, that is, approximately 1 per cent (1/16-inch) of full scale. (If the meter indicates an appreciable deflection in either direction of more than 1 per cent, an internal adjustment may be required. See step 3, preceding. If no adjustment is required, continue the operational check.)

Step 5. Set the attenuator to the CAL position.

Step 6. Set the function switch to the CAL position.

Step 7. Rotate the PEAK control R231 maximum clockwise.

Step 8. Rotate the PEAK SENS. control R191 clockwise until the PEAK indicator lamp I102 lights, then rotate the control counterclockwise until the lamp just ceases to blink.

Step 9. Adjust the PEAK control R231 for the output meter indication provided on the calibration Charts Nos. 1 and 2 for the r-f frequency desired.

Step 10. Turn the CALIBRATE control R128 clockwise until the PEAK indicator lamp I102 blinks at the impulse calibrator repetition rate (approximately 12 to 15 pulses per second), then rotate the control slowly counterclockwise until the lamp just ceases to blink.

Note

The exact calibrator repetition rate may differ between equipments.

Step 11. The equipment is now standardized for gain.

Note

This standardization procedure is valid for only one frequency. Repeat the entire procedure (steps 5 through 10) for each new frequency.

Step 12. Set function switch to FIELD INTENSITY position. Using an appropriate antenna, tune through the six frequency bands listening for signals to determine that the equipment operates on each band. Select an attenuator setting for on-scale meter indication and an AUDIO control R182 setting required to give a comfortable audio volume level in the headphones.

Step 13. Check the slide-back feature of the equipment as follows: With the antenna still connected, and with the equipment tuned to a modulated (or interference) signal, turn the function switch to the PEAK position. From its fully counterclockwise position, turn the PEAK control slowly in a clockwise direction until the received headphone signal just becomes inaudible. Observe the pointer of the indicating meter as the point of inaudibility is approached. If the pointer goes off-scale, set the attenuator control to the next higher position, using the required PULL-TURN-PUSH sequence. Return the PEAK control to the fully counterclockwise position, then readjust until the headphone signal just becomes inaudible.

b. ORIENTING THE DIPOLE ANTENNA. *(See figures 3–7, 3–8, and 3–9.)*–Approximate magnetic bearings of a signal source may be obtained with Radio Interference Measuring Set AN/URM-47. The approximate bearing of the signal source is given by the azimuth circle on the tripod head on which the antenna and antenna mast are mounted. However, each time the tripod is moved from one location to another, the azimuth dial must be oriented with respect to magnetic north. One method to accomplish this alignment and orientation is by means of the Observer Compass MARK 1 MOD 0 (not furnished).

The observer compass was designed for obtaining distant shore bearings from a ship. It consists of a liquid-filled compass bowl and card with means of illuminating the card, and a prism for permitting the direct reading of the card while sighting upon an object. A two-cell flashlight of non-ferrous construction, without the usual head containing lens and reflector, is fitted into the bottom of the compass bowl. The light from the flashlight bulb passes through a red plate to the translucent compass card. A switch on the side of the flashlight turns the light on and off. The prism above the compass

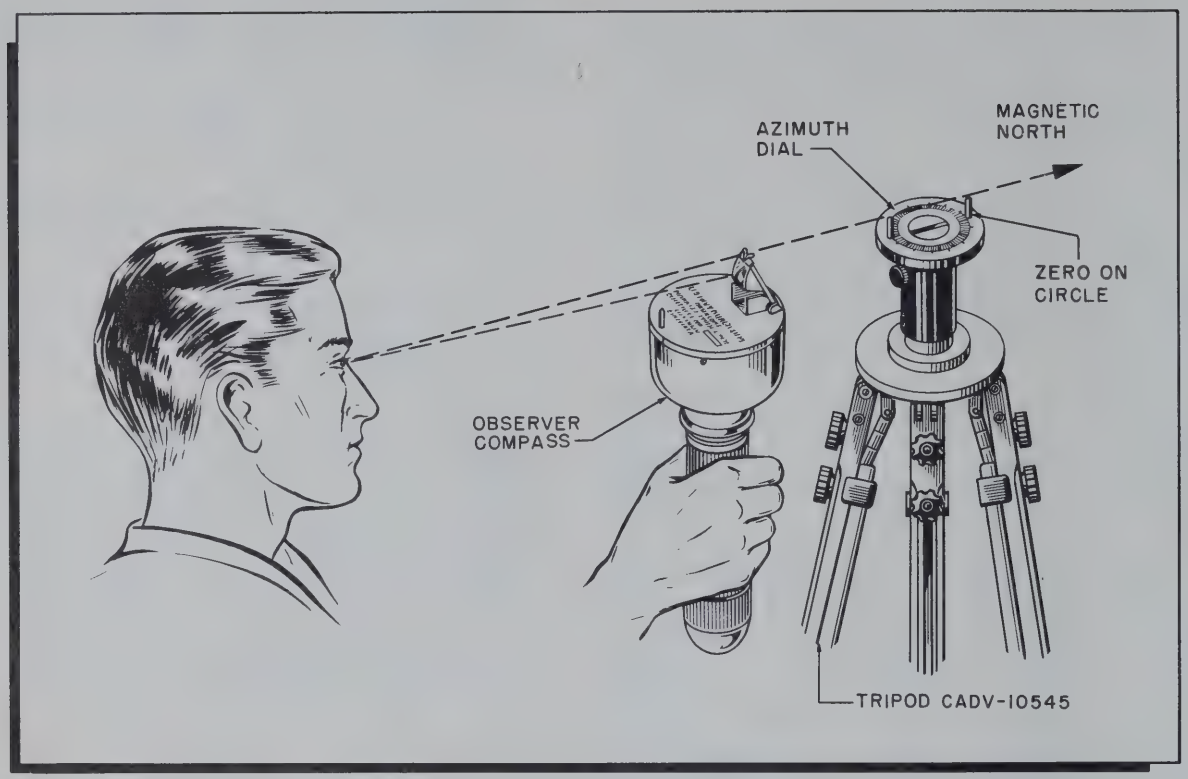


Figure 3–7. Method of Indexing Azimuth Dial on Tripod

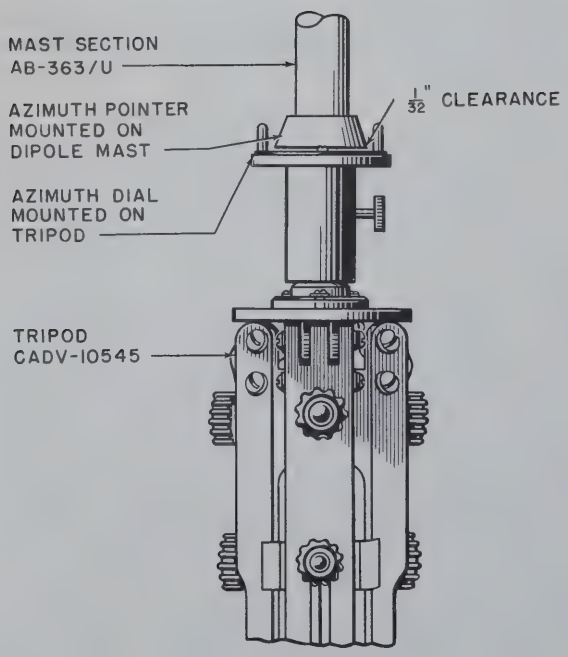


Figure 3–8. Azimuth Dial and Azimuth Pointer Assemblies Mounted on Tripod

is hinged to provide an adjustment in the angle between the line of sight from the eye to the distant point being observed and the image of the compass card in the prism. An open sight is also provided on the prism mounting. The lubber line above the compass card functions as the other sight in alignment with the object on which bearings are being taken.

CAUTION

Iron objects should be removed from pockets and all metallic tools, etc., should be removed from the vicinity before reading the magnetic compass. Magnetic compasses are particularly unreliable near power lines and near metallic structures.

To orient the azimuth dial, temporarily remove the dipole antenna and the antenna mast. Turn the azimuth dial so that zero is at the north side as close as may be estimated. Hold the compass upright and level in the hands or, if possible, resting upon a support of suitable height. Take a position such that the open sight above the prism on the compass is on a level with the sighting pins of the azimuth dial. Adjust the prism up or down until the compass card can be seen clearly. Then vary the position of the observer until the compass card reads exactly north (360 degrees), the open sight and the lubber line are exactly in line with the 360-degree mark, and the line of sight passes directly over both of the sighting pins of the azimuth dial. It will be necessary to

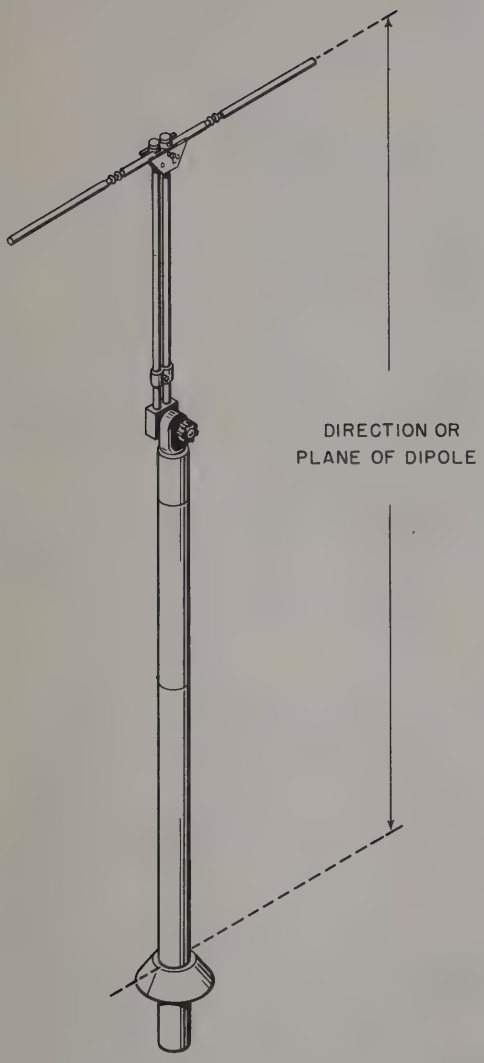


Figure 3–9. Method of Checking Azimuth Pointer Assembly for Angular Position

turn the dial to adjust its position as successive sights are taken with the observer compass, until the desired alignment is attained. At this point, tighten the lock screw on the azimuth dial, being careful not to move the dial while doing so.

There is an efficient bubble trap around the periphery of the compass bowl. If a bubble appears during the use of the compass, turn the compass upside down and slowly return it to the upright position. This puts the bubble behind the bubble trap where it will not be visible nor disturb the action of the compass card.

Place the mast section in the sleeve on the tripod head (see figure 3–8). Tighten the mast screw under the tripod head to secure the mast to the tripod. Check that the index line on the azimuth pointer assembly on the base of the mast is directly in line with the vertical azimuth dial pins. If necessary, the azimuth pointer can be moved as follows: Loosen the two set screws on the pointer with an Allen wrench. With the pointer at the proper position to provide a clearance above the azimuth dial (1/32 inch), turn the pointer to bring the index line in line with the plane of the dipole (see figure 3–9). Tighten the two set screws. Make certain that the spring steel collar inside the azimuth pointer is in place when the set screws are tightened.

7. TRANSPORTING THE EQUIPMENT.

a. PACKING IN CARRYING CASES.—Safe stowage for each unit and accessories of Radio Interference-Field Intensity Meter AN/URM-47 is provided in the carrying cases supplied. These cases are adequate packing for transporting the equipment from one survey site to another.

Note

The interior of each carrying case contains a plate displaying the equipment which should be packed in the individual carrying case. To prevent loss of equipment, personnel responsible for repacking the equipment should place a check mark in the box following the name of each item as it is packed in the case. (See figures 1–2, 1–4, and 1–6.)

Wipe all units and accessories with a dry cloth before stowing in the cases. This applies in particular to the tripod. In order to stow the tripod properly and to protect the sighting pins on the azimuth dial, invert the dial over the sleeves on the tripod head. Insert a finger in the azimuth dial assembly to compress the internal leaf spring. The azimuth dial assembly will then fit over the sleeves of the tripod head. Replace the various units in the cases in the positions they occupied when received. Be sure to collapse the tripod legs fully before stowing in its case. When the RI-FI Meter is replaced in its case, make certain that the four rubber feet of the unit are toward the back of the carrying case (toward the hinged portion of the case cover). When replacing the low-frequency dipole antenna, make sure that the mast is turned to the position marked STOW on the front of the dipole head, otherwise it will not fit into its carrying case.

CAUTION

The carrying cases are drip-proof but not designed to withstand severe exposure to the elements. Cases should be covered with tarpaulin when left in the open overnight.

b. PACKING IN SHIPPING CASE.—The three carrying cases are not intended to be sufficient packing for transport by common carrier. Pack the carrying cases in the original shipping case as shown in figure 3–1. If the original shipping case was not retained, construct one according to the data in that illustration. Use 3/4-inch lumber and provide the required waterproof barriers and cellulose wadding.

SECTION 4

OPERATION

1. INTRODUCTION.

Radio Interference Measuring Set AN/URM-47 is basically a meter intended for intensity measurements of all types of radio-frequency energy in the frequency range of 20 to 400 megacycles.

The RI-FI Meter includes a sensitive receiver and a vacuum-tube voltmeter (VTVM) section. It also contains internal means for standardizing the receiver gain.

With an input impedance of 50 ohms, r-f voltage from 1 microvolt to 1.0 volt may be measured. In terms of field intensity, 1.2 microvolts-per-meter to 60 volts-per-meter (depending on frequency) may be measured utilizing the antennas furnished.

In operation, the type of measurement is selected by means of the function switch. The FIELD INTENSITY function of the RI-FI Meter affords measurement in

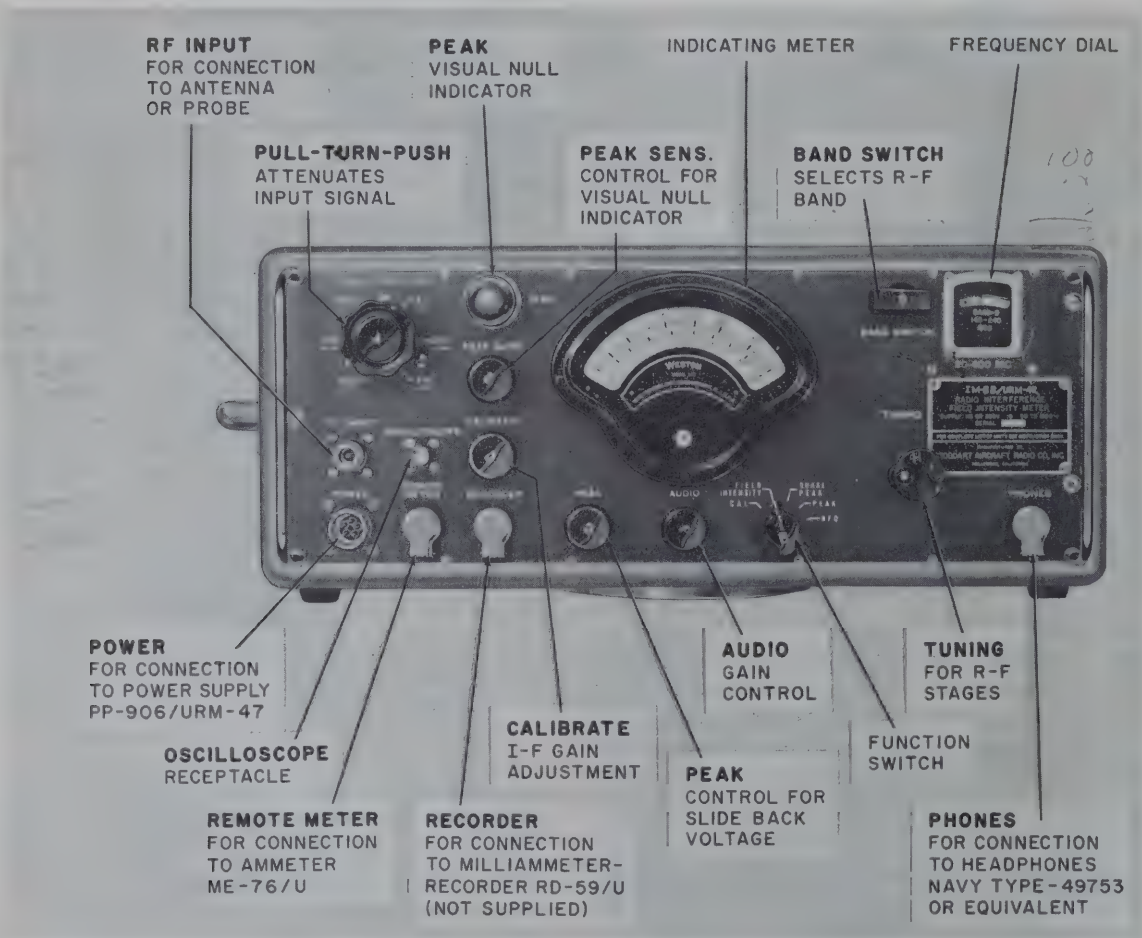


Figure 4–1. Radio Interference-Field Intensity Meter IM-88/URM-47, Panel Controls and Receptacles

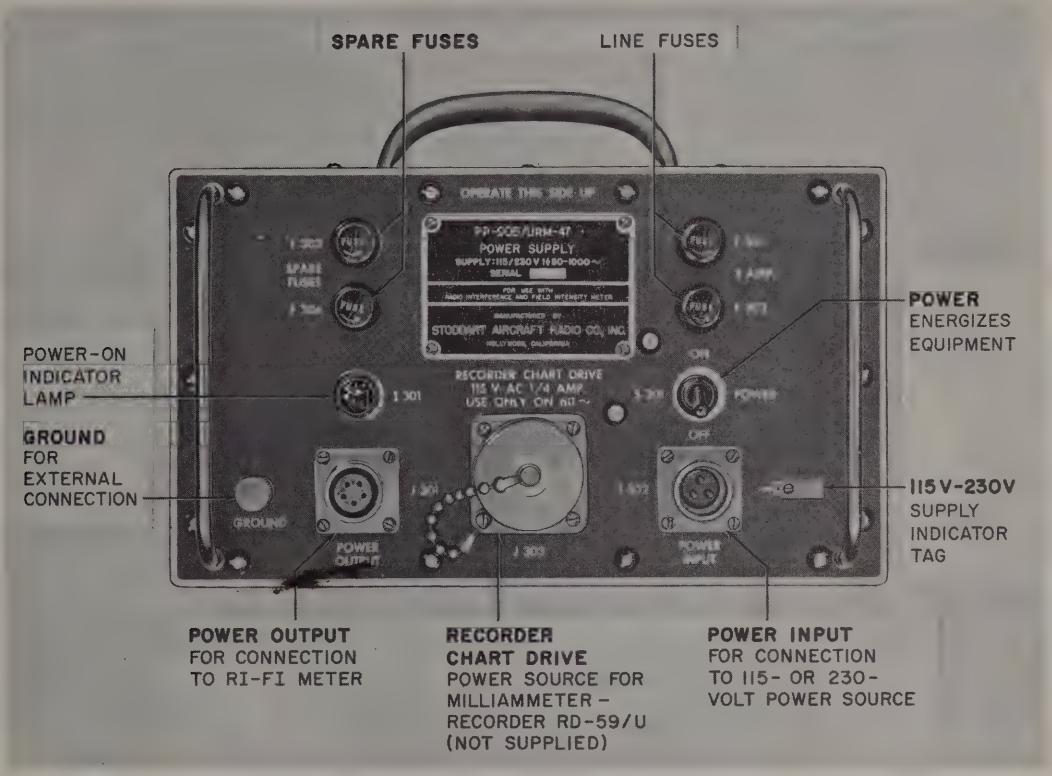


Figure 4—2. Power Supply PP-906/URM-47, Panel Controls and Receptacles

terms of the average value, the QUASI PEAK function in terms of the weighted value, and the PEAK function in terms of the peak value of the signal or interference as it appears at the input to the second detector.

The RI-FI Meter does not measure the absolute peak value of impulsive interference because impulsive response is dependent upon the effective impulsive bandwidth, the energy of the pulse (product of amplitude and duration), and the second detector characteristics of the measuring equipment. The effective duration (duration of rectangular envelope of the same peak value) of the pulse, after passing through the various tuned circuits, is exactly inverse of the RI-FI Meter effective impulsive bandwidth. Tuned circuits in the RI-FI Meter shape the pulse signal so that its peak amplitude is decreased and its duration is lengthened. The PEAK function of the RI-FI Meter measures the peak value of the shaped pulse as it appears at the input to the second detector. This value can be converted to a per-megacycle-bandwidth basis by application of a factor depending upon the effective impulsive bandwidth of the RI-FI Meter at the measured frequency. When expressed in terms of per-megacycle-bandwidth, the result may be correlated with similar readings obtained from other measuring equipment expressed in the same units.

2. EQUIPMENT CONTROLS AND RECEPTACLES.

(See figures 4—1 and 4—2.)

The operating controls of the RI-FI Meter and Power Supply PP-906/URM-47 are all located on the front panel of the units. The receptacles to which external connections are made are also located on the front panels.

The function of each control and receptacle is briefly described by an adjacent panel marking or by panel markings identifying the various control positions. In table 4—1, the panel marking or legend is explained and the applicable symbol designation is given in parentheses after the legend to aid in identifying the circuit components. As another means of identification, control knobs have been colored and marked with a letter; these letters and knob colors precede the panel marking.

3. DESCRIPTION OF CHART SET PT-188/URM-47.

(See figures 4—3 through 4—8.)

Chart Set PT-188/URM-47 consists of a series of eleven vinylite sheets containing simplified operating instructions and a family of calibration curves that are plotted *for each individual* RI-FI Meter.

The first two sheets supply simplified operating instructions, including instructions for the proper use of the curves on succeeding sheets.

Note

Sample curves are plotted in the chart illustrations given here. *Do not use these sample charts for calibrating equipments.*

Before making a measurement on a given frequency, it is necessary to adjust the gain of the RI-FI Meter, by

TABLE 4–1. DESIGNATION AND FUNCTION OF PANEL CONTROLS AND RECEPTACLES

LEGEND	FUNCTION
	RI-FI Meter
(A) (BLACK) PULL-TURN-PUSH (S101, E136 through E141)	Attenuation control.
CAL	Blanks r-f input to receiver and connects impulse generator to receiver input.
X1 0DB	Does not attenuate i-f or r-f signal.
X10 +20DB	Does not attenuate r-f signal but does attenuate i-f signal 20 db.
$X10^2$ +40DB	Attenuates r-f signal 20 db and i-f signal 20 db.
$X10^3$ +60DB	Attenuates r-f signal 40 db and i-f signal 20 db.
$X10^4$ +80DB	Attenuates r-f signal 60 db and i-f signal 20 db.
RF INPUT (J101)	R-f input receptacle.
POWER (J106)	Power input receptacle.
OSCILLOSCOPE (J107)	Oscilloscope receptacle for visual monitoring.
REMOTE METER (J110)	Receptacle for remote meter connection.
PEAK (I102)	Indicator lamp to provide a visual null indication.
(E) (GREEN) PEAK SENS. (R191)	Control for visual null indication.
(D) (RED) CALIBRATE (R128)	Adjusts gain of i-f section to standardize receiver gain.
RECORDER (J111)	Receptacle for milliammeter recorder connection.
(C) (GREEN) PEAK (R231)	Control for furnishing slide-back voltage for peak measurements.
(F) (BLACK) AUDIO (R182)	Adjusts aural monitoring level.
(B) (BLACK) Function Switch (S102)	
CAL	Position used for standardizing receiver gain. Places calibrator circuit in operation.
FIELD INTENSITY	Weights signal for field intensity measurements.
QUASI PEAK	Weights signal for quasi-peak measurements.
PEAK	Provides signal to detector for slide-back voltage measurements.
BFO	Places beat frequency oscillator in operation for c-w reception. BFO not used in making measurements; used for identification of signals only.
(G) (BLACK) BAND SWITCH	Selects tuned circuits in the r-f amplifier, mixer, and local oscillator stages for six frequency bands.
(H) (BLACK) TUNING	Operates tuning capacitors of the r-f amplifier, mixer, and local oscillator stages to vary tuning.
PHONES (J108)	Headphone receptacle for aural monitoring.

TABLE 4–1. DESIGNATION AND FUNCTION OF PANEL CONTROLS AND RECEPTACLES (Cont'd)

LEGEND	FUNCTION
	Power Supply
GROUND	Ground post for connection to external ground.
F303, F304	3-ampere spare fuses.
I301	Power-on indicator lamp.
POWER OUTPUT (J301)	Receptacle for operating potential supply to RI-FI Meter.
RECORDER CHART DRIVE (J303)	Power source for Milliammeter-Recorder RD-59/U, or equivalent. *Used only when external power source frequency is 60 cycles.*
F301, F302	3-ampere active line fuses.
POWER (S301)	
ON	Energizes the equipment.
OFF	De-energizes the equipment.
POWER INPUT (J302)	Receptacle for external source input power.

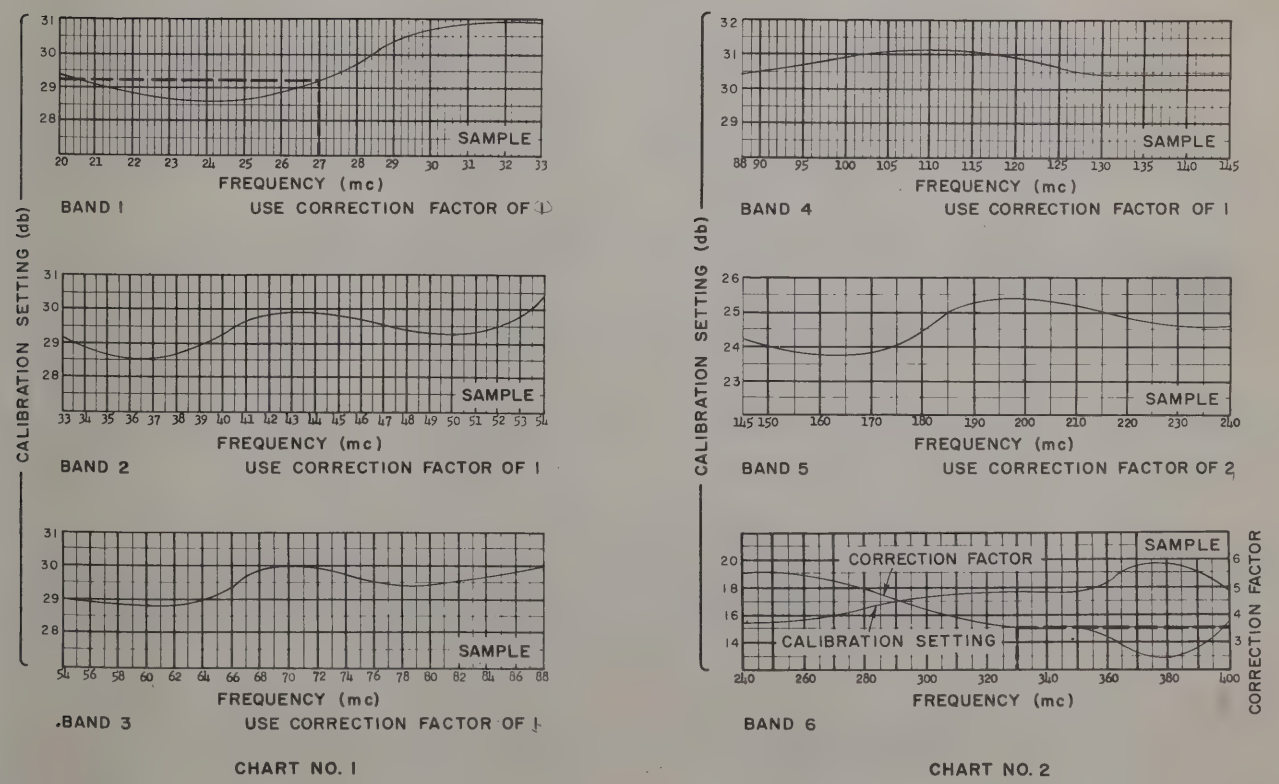
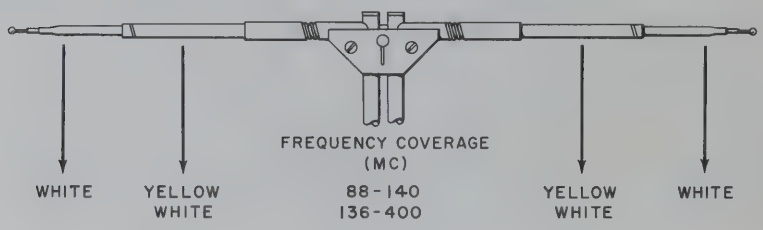
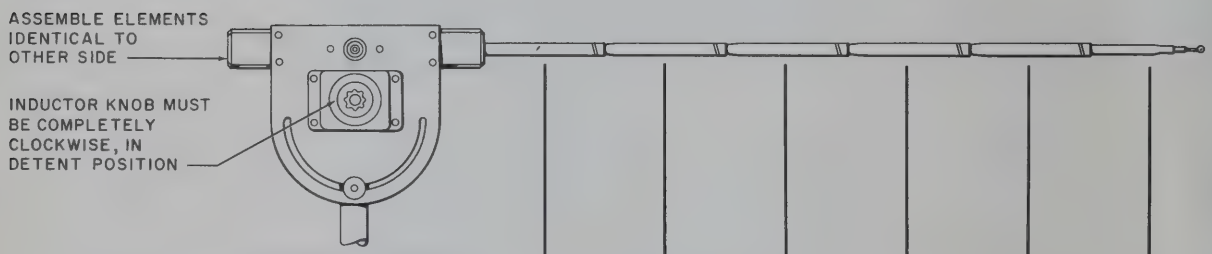


Figure 4–3. Calibration Settings, Bands 1 through 6 (Charts Nos. 1 and 2)

1. HIGH FREQUENCY DIPOLE: MAST AB-371/U (88-400 MC)



2. LOW FREQUENCY DIPOLE: ANTENNA AT-477/U (20-88 MC)



FREQUENCY COVERAGE (MC)						
20-23	RED	RED	RED	YELLOW	GREEN	BLUE
22-26	RED	RED	RED	GREEN	BLUE	
26-33	RED	RED	GREEN	BLUE		
32-44	RED	GREEN	BLUE			
42-63	GREEN	BLUE				
54-70	RED	YELLOW	WHITE			
70-88	RED	WHITE				

3. FIXED LENGTH DIPOLE: ANTENNA AT-477/U (20-50 MC)

ADJUST DIPOLE LENGTH TO 50 MEGACYCLES (USE TABLE 2 ABOVE). TUNE INDUCTOR FOR MAXIMUM READING OF OUTPUT METER AT FREQUENCY OF SIGNAL BEING MEASURED. ALTERNATIVELY, USE FOLLOWING APPROXIMATE VALUES OF SCALE SETTING VS. FREQUENCY.

FREQUENCY (MC)	INDUCTOR SCALE	FREQUENCY (MC)	INDUCTOR SCALE
20	2.6	35	8.1
22	4.4	40	9.0
25	5.3	45	9.5
30	7.0	50	DETENT

4. VERTICAL ANTENNA: ANTENNA BASE AB-364/U (20-400 MC)

THE VERTICAL ANTENNA IS CONSIDERED AS ONE-HALF OF A DIPOLE. USE DATA SHOWN ABOVE FOR ADJUSTING ONE-HALF DIPOLE. VERTICAL ANTENNA FACTORS SHOWN ON CHART NO. 5 ARE BASED ON THE USE OF A GROUND PLANE ATTACHED TO THE ANTENNA BASE CONSISTING OF 24 COPPER WIRES 160 INCHES LONG RADIATING EVENLY ABOUT THE CENTER.

CHART NO. 3

Figure 4–4. Antenna Adjustments Data (Chart No. 3)

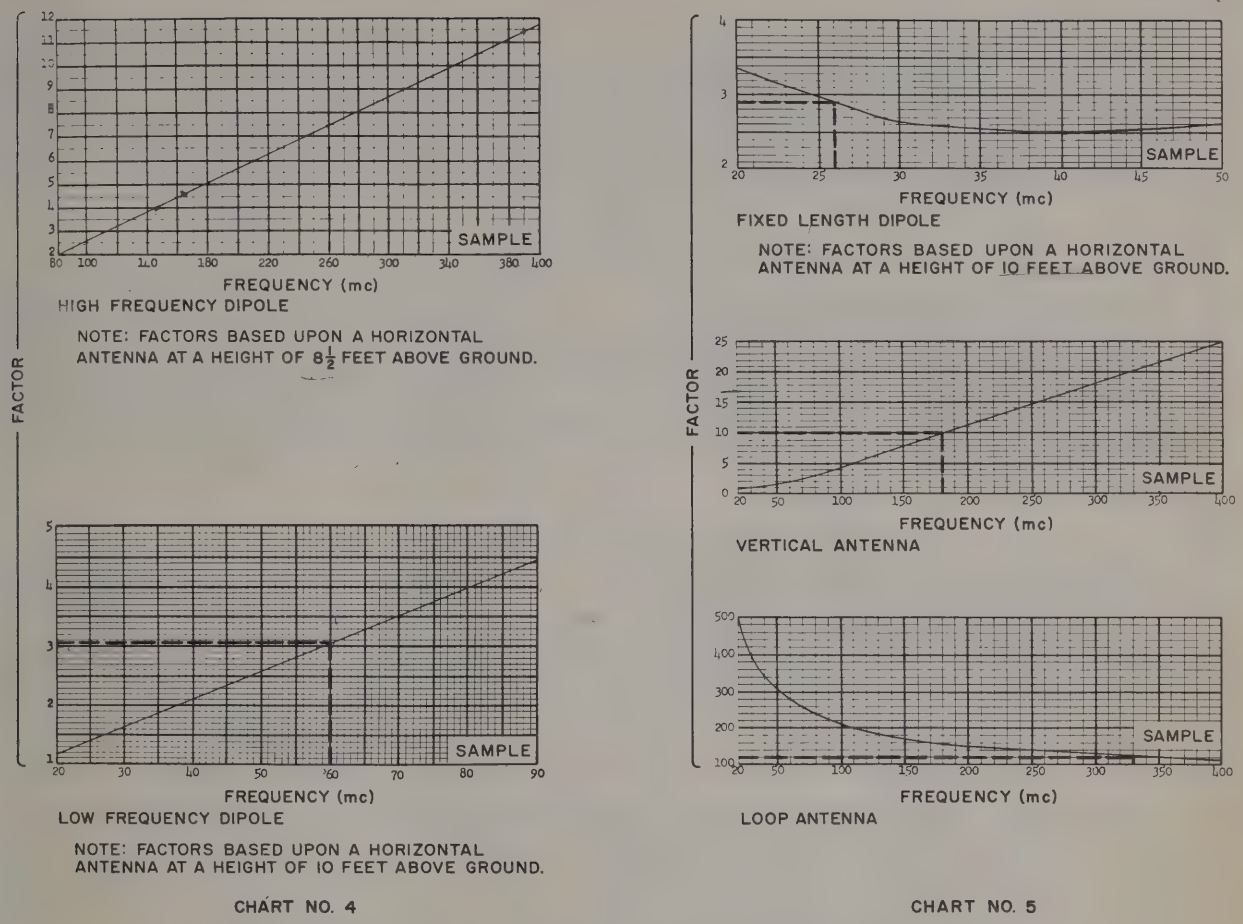

FACTOR
SAMPLE
FREQUENCY (mc)
HIGH FREQUENCY DIPOLE
NOTE: FACTORS BASED UPON A HORIZONTAL ANTENNA AT A HEIGHT OF 8½ FEET ABOVE GROUND.
LOW FREQUENCY DIPOLE
NOTE: FACTORS BASED UPON A HORIZONTAL ANTENNA AT A HEIGHT OF 10 FEET ABOVE GROUND.
FIXED LENGTH DIPOLE
NOTE: FACTORS BASED UPON A HORIZONTAL ANTENNA AT A HEIGHT OF 10 FEET ABOVE GROUND.
VERTICAL ANTENNA
LOOP ANTENNA
CHART NO. 4
CHART NO. 5

Figure 4–5. Correction Factors (Charts Nos. 4 and 5)

means of the CALIBRATE control (D). The calibration reading is taken from Charts Nos. 1 and 2 which contain six curves covering the six frequency bands (figure 4–3).

Chart No. 3 (figure 4–4) provides antenna assembly data in tabular form. Information is presented for selection of antenna head, number and type of antenna sections, and assembly sequence for tuning an antenna to a desired frequency.

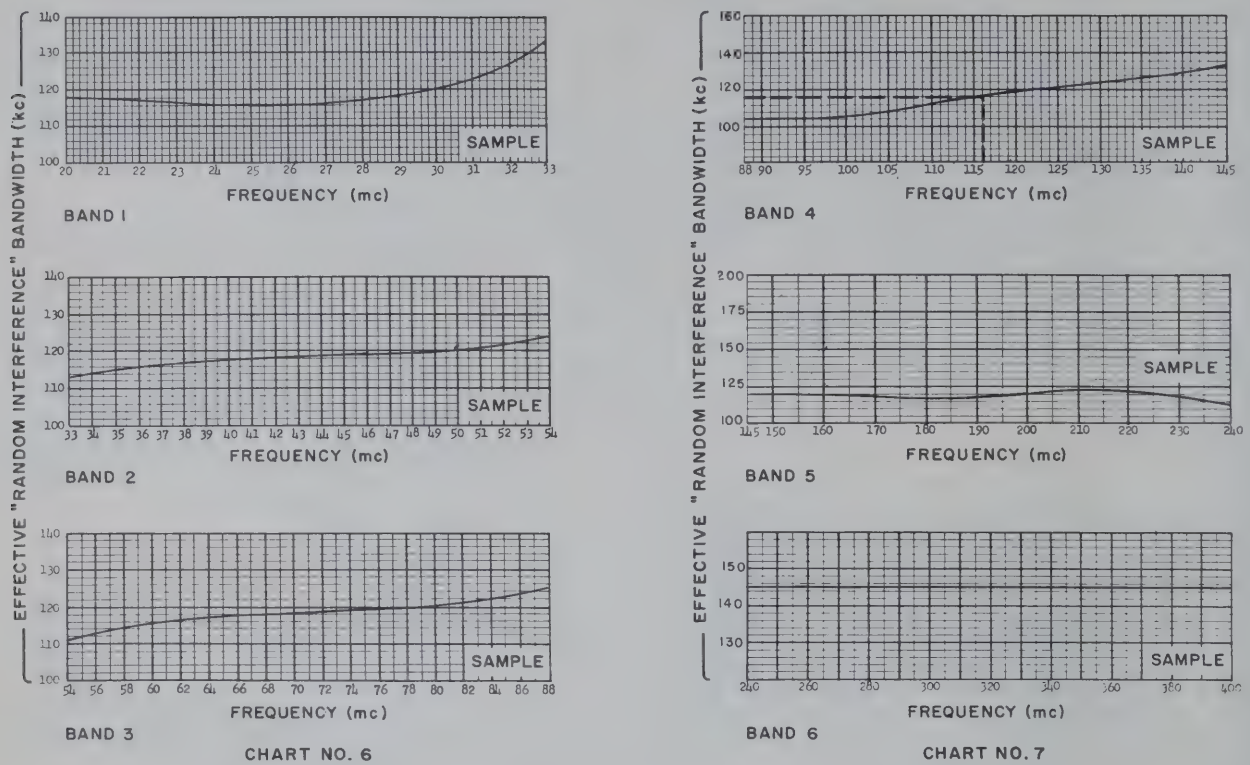
Chart No. 4 (figure 4–5) contains curves for determining the $\lambda/2$ self-resonant dipole correction factor at any frequency throughout the six bands. These factors, when multiplied by the meter reading in microvolts, result in the field intensity measurement in microvolts-per-meter.

Chart No. 5 (figure 4–5) contains a curve for determining the dipole correction factor at any frequency between 20 and 50 megacycles when the dipole length is fixed at a self-resonant length at 50 megacycles. This is useful where space is limited and it is not practical to extend the dipole elements to the lower frequency $\lambda/2$ dipole self-resonant length. These factors, when multiplied by the meter reading in microvolts, result in the field intensity measurement in microvolts-per-meter. Chart No. 5 also contains a curve for determining the approximate vertical antenna correction factor at any frequency throughout the six bands. These factors, when multiplied by the meter reading in microvolts, result in the approximate field intensity in microvolts-per-meter. Chart No. 5 also contains a curve for determining the approximate loop probe correction factor at any frequency throughout the six bands. These factors, when multiplied by the meter reading in microvolts result in the approximate field intensity in microvolts-per-meter.

Charts Nos. 6 and 7 (figure 4–6) contain curves for determining the effective "random interference" bandwidth for any given frequency within the range of the equipment. Included on the charts are factors by which the effective "random interference" bandwidth may be converted to the 6 db bandwidth or to the effective impulsive bandwidth. A detailed description on the use of these different bandwidths is given in paragraph 7.*b.* (3).

Note

Wherever the terms "Random Noise Bandwidth" and "Impulse Noise Bandwidth" appear in Chart Set PT-188/URM-47, these terms are the "Effective Random Interference Bandwidth" and "Effective Impulsive Bandwidth", respectively.



NOTES: THE EFFECTIVE IMPULSIVE BANDWIDTH CAN BE DETERMINED BY MULTIPLYING THE EFFECTIVE "RANDOM INTERFERENCE" BANDWIDTH BY A FACTOR OF 1.50.

THE 6 db BANDWIDTH CAN BE DETERMINED BY MULTIPLYING EFFECTIVE "RANDOM INTERFERENCE" BANDWIDTH BY A FACTOR OF 1.35.

Figure 4–6. Bandwidth Data, Bands 1 through 6 (Charts Nos. 6 and 7)

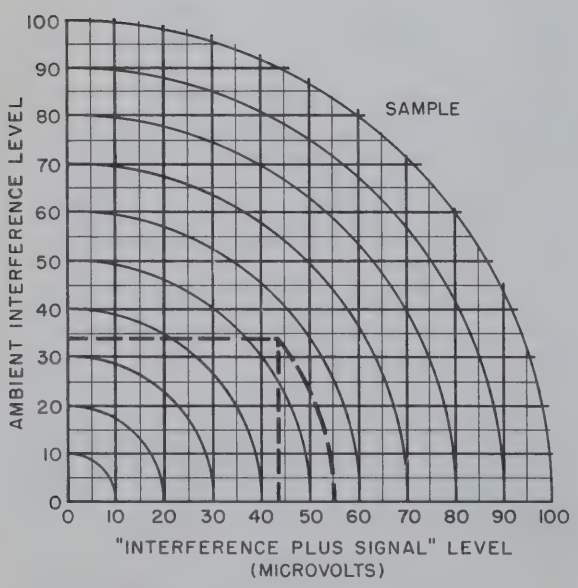


Figure 4–7. Correction Chart for Sine Wave Signals in the Presence of High Ambient Interference of Random Nature

Chart No. 8 (figure 4–7) is a correction chart used for determining a true measurement of sine wave signal strength in the presence of high ambient interference of random nature. Two measurements are required—one of the signal plus interference, and one of the interference alone.

Chart No. 9 (figure 4–8) is in two parts. One part is a scale from which the square root of the bandwidth may be determined. It is used when converting microvolt readings of random interference to microvolt-per-kilocycle values. The other part is a chart which supplies correction factors for use when measuring impulsive interference signals directly in terms of microvolts-per-kilocycle bandwidth.

4. OPERATING INSTRUCTIONS.

a. INTRODUCTION.—Instructions for connecting the various input devices and the remote meter are given in Section 3. A statement of the type of input device required will be given here.

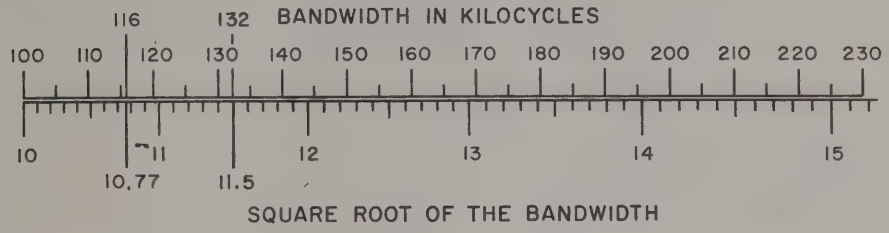
Note

The word "signal" is used here to designate any r-f input to the equipment, i.e., sine wave, random interference, or impulsive interference.

CHART FOR DETERMINING THE SQUARE ROOT OF THE BANDWIDTH

For use when converting microvolt readings of random interference to microvolt-per-kilocycle values

1. Refer to Charts No.6 and No.7 for the effective "random interference" bandwidth
2. Locate the bandwidth value on upper scale of the chart.
3. The square root value of the bandwidth will be found directly below on the lower scale.



CORRECTION FACTORS WHEN MEASURING PULSE INTERFERENCE

For improved accuracy when measuring impulsive interference signals directly in terms of microvolts-per-kilocycle bandwidth. These factors compensate for the CG-92D/U(20') cable losses.

1. Enter the chart from the bottom at the frequency of the signal being observed. Follow upward to intersect the plotted curve.
2. From the point of intersection, follow to the left to find the correction factor.

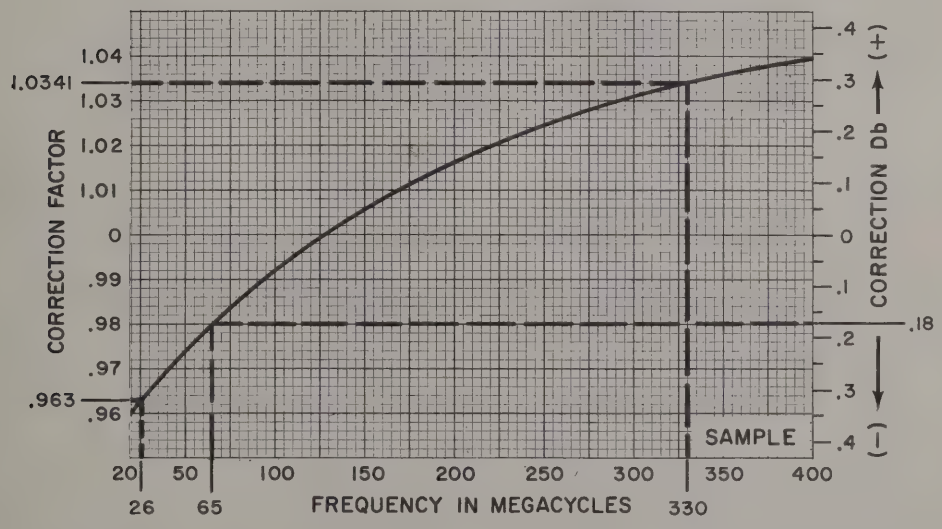


Figure 4–8. Impulsive Interference Signal Correction Factors and Square Root Scale for Bandwidth (Chart No. 9)

The input devices include the low- and high-frequency dipole antennas, vertical antenna, and loop antenna. These units are all connected via Cable Assembly CG-92D/U (20′ 0″) to the RF INPUT receptacle J101.

b. USE OF DIPOLE ANTENNAS.—The dipole antenna is used for field intensity and interference measurement, that is, for measuring the intensity of the signal in microvolts-per-meter, and determining the approximate bearing of a signal source. The antenna must be adjusted for frequency, height above ground, type of polarization, and incident angle of the received signal.

(1) MAST AB-371/U AS A HALF-WAVE DIPOLE.—This antenna is used as a self-resonant dipole in the frequency range 88 to 400 megacycles. See figure

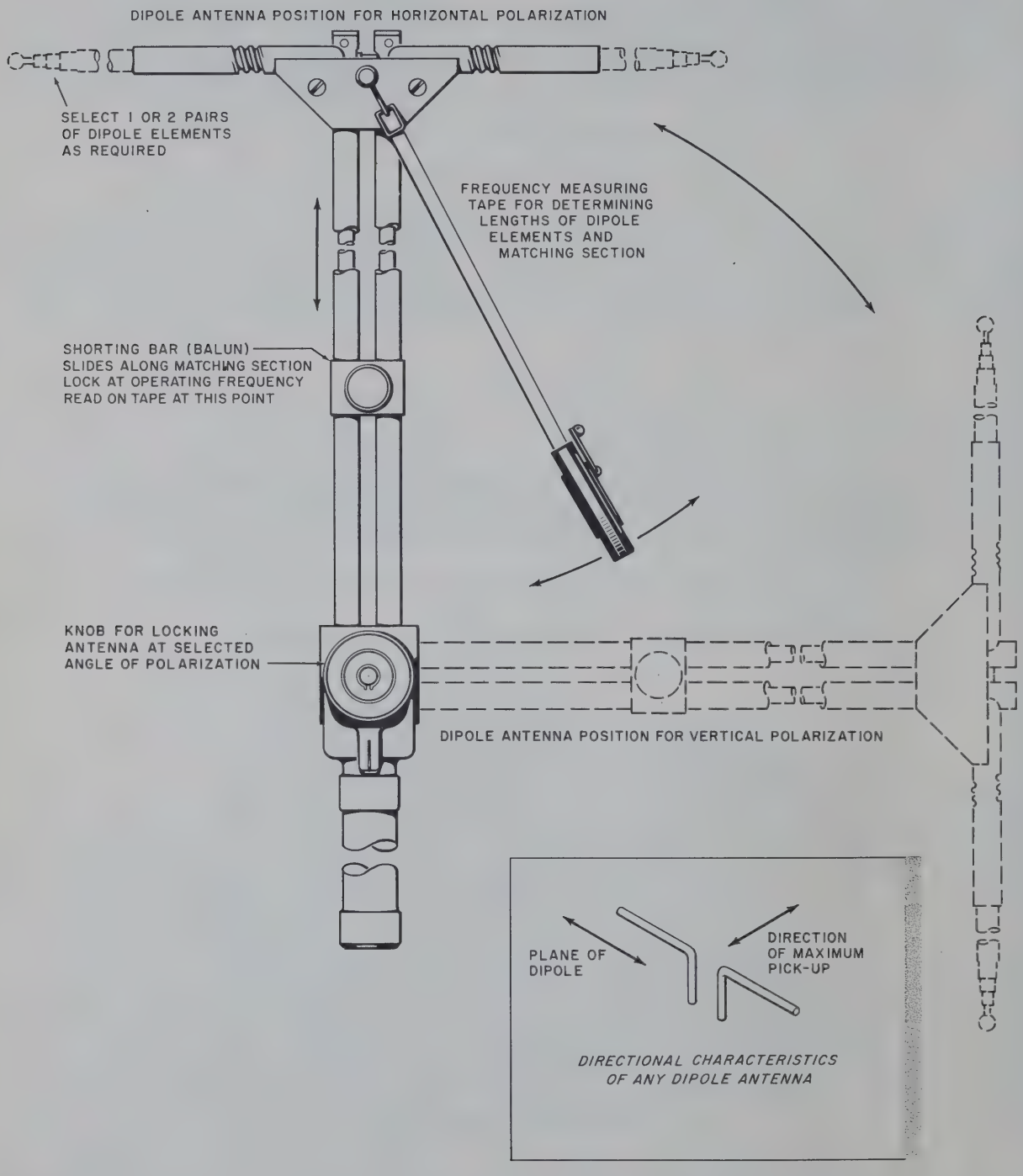

DIPOLE ANTENNA POSITION FOR HORIZONTAL POLARIZATION
SELECT 1 OR 2 PAIRS OF DIPOLE ELEMENTS AS REQUIRED
FREQUENCY MEASURING TAPE FOR DETERMINING LENGTHS OF DIPOLE ELEMENTS AND MATCHING SECTION
SHORTING BAR (BALUN) SLIDES ALONG MATCHING SECTION LOCK AT OPERATING FREQUENCY READ ON TAPE AT THIS POINT
KNOB FOR LOCKING ANTENNA AT SELECTED ANGLE OF POLARIZATION
DIPOLE ANTENNA POSITION FOR VERTICAL POLARIZATION
PLANE OF DIPOLE
DIRECTION OF MAXIMUM PICK-UP
DIRECTIONAL CHARACTERISTICS OF ANY DIPOLE ANTENNA

Figure 4–9. Adjustment of Mast AB-371/U (High-frequency Dipole)

4–9 for illustration of the high-frequency dipole antenna adjustments. The end of Measuring Tape TL-635/U is attached to the hook at the top of the antenna and pivoted thereby so the length of the telescoping sections and balun shorting bar can be adjusted to correspond to the operating frequency. For operation at 130 megacycles, for example, use two yellow rods and two white telescoping sections (see Chart No. 3). Screw the yellow rods into dipole head stubs and screw the white telescoping sections into end of rods. Adjust the telescoping sections so the outer ends coincide with the 130-megacycle index on the frequency tape. Pivot the tape to the axis of the matching stubs. Loosen the lock screw on the shorting bar and adjust the *upper edge*

TABLE 4—2. FREQUENCY vs. ANTENNA ELEMENT LENGTH

Notes

1. This table is to be used only when Measuring Tape TL-635/U is not available.
2. For one-half dipole length, measure from center of pin on head.
3. Subtract 1/2 inch from measurements if measured from hook of antenna.

INCHES FROM END	FREQ. (mc)	INCHES FROM END	FREQ. (mc)	INCHES FROM END	FREQ. (mc)	INCHES FROM END	FREQ. (mc)	INCHES FROM END	FREQ. (mc)
7.5	400	11.89	250	20.77	140	41.6	70	86.6	34
7.7	390	12.42	240	21.47	135	44.6	65	89.0	33
7.9	380	13.0	230	22.22	130	48.4	60	91.5	32
8.12	370	13.65	220	23.05	125	53.25	55	94.3	31
8.35	360	14.36	210	24.05	120	59.0	50	97.2	30
8.58	350	15.08	200	25.2	115	61.8	48	100.5	29
8.79	340	15.86	190	26.42	110	64.6	46	104.0	28
9.02	330	16.66	180	27.85	105	67.6	44	107.6	27
9.29	320	17.08	175	29.5	100	70.8	42	111.5	26
9.57	310	17.53	170	31.37	95	74.25	40	115.7	25
9.86	300	18.0	165	33.35	90	76.1	39	120.3	24
10.19	290	18.48	160	34.2	88	78.0	38	125.3	23
10.55	280	18.98	155	35.2	85	80.0	37	130.7	22
10.97	270	19.54	150	37.0	80	82.0	36	137.25	21
11.42	260	20.13	145	39.1	75	84.25	35	145.0	20

of the bar to coincide with the 130-megacycle index on the frequency tape. Tighten the lock screw. The high-frequency half-wave dipole correction factors provided in Chart No. 4 are based on an antenna in a horizontal position and at a height of 8-1/2 feet above ground.

Note

Use table 4—2, Frequency vs. Antenna Element Length, when Measuring Tape TL-635/U is not available to the operator.

(2) ANTENNA AT-477/U AS A HALF-WAVE DIPOLE.—This antenna is used in the frequency range 20 to 88 megacycles. See figure 4—10 for illustration of low-frequency dipole adjustments. The end of Measuring Tape TL-635/U is attached to the hook at the top of the antenna and pivoted thereby so the length of the telescoping sections can be adjusted to correspond to the operating frequency. For operation at 22 megacycles, for example, use six red rods, two yellow rods, two green tapered rods and two blue telescoping sections (see Chart No. 3). Assemble these sections by screwing together and to the dipole head in the order given. Adjust the telescoping sections so the outer ends coincide with the 22-megacycle index on the frequency tape. The low-frequency half-wave dipole correction factors provided in Chart No. 4 are based on an antenna in a horizontal position and at a height of 10 feet above ground.

Note

Be sure that the tuning knob mounted on the dipole head is in the extreme clockwise position (in detent position) when using the antenna as a self-resonant dipole.

(3) ANTENNA AT-477/U AS A FIXED-LENGTH DIPOLE.—This antenna is used in the frequency range of 20 to 50 megacycles. See figure 4—10 for illustration of the fixed-length dipole adjustments. The end of Measuring Tape TL-635/U is attached to the hook at the top of the antenna and pivoted thereby so the length of the telescoping sections can be adjusted to the 50-megacycle mark on the tape. For operation at 27 megacycles, for example, use two tapered green and two blue telescoping sections (see Chart No. 3) and make the adjustments as above. Then rotate the tuning knob mounted on the dipole head for maximum reading of output meter. When it is impossible to tune knob and observe the meter at the same time, use approximate values of scale settings vs. frequency shown on Chart No. 3. The fixed

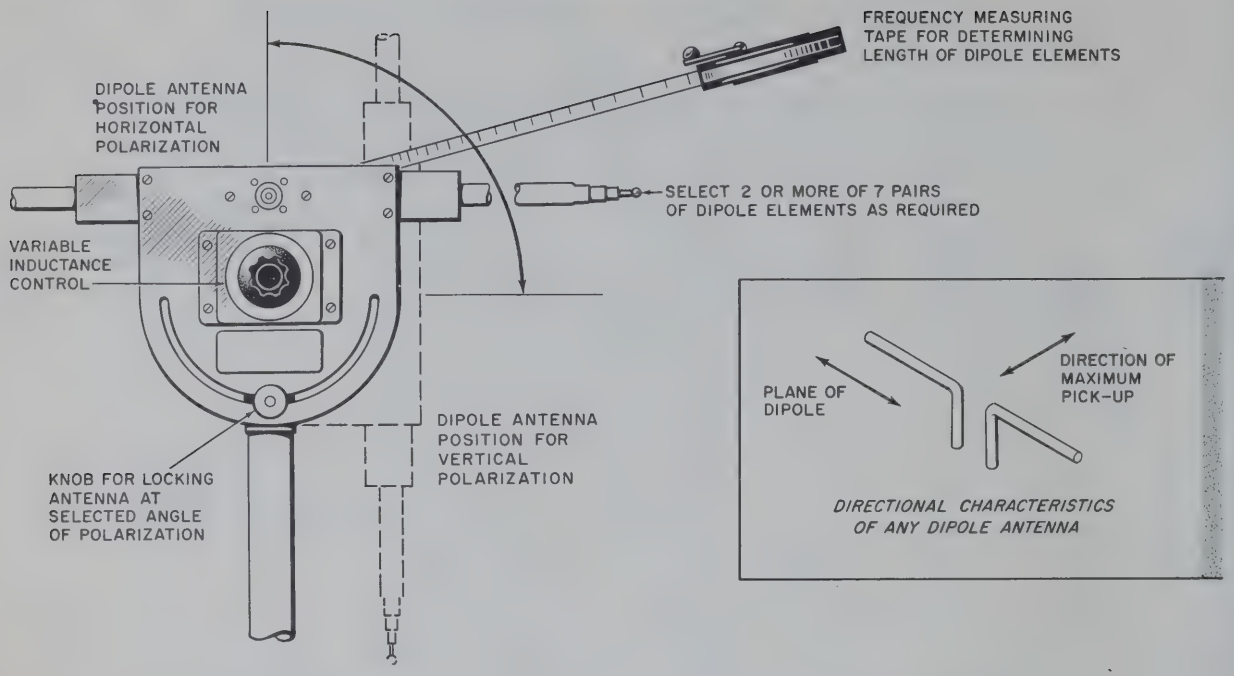

FREQUENCY MEASURING TAPE FOR DETERMINING LENGTH OF DIPOLE ELEMENTS
DIPOLE ANTENNA POSITION FOR HORIZONTAL POLARIZATION
SELECT 2 OR MORE OF 7 PAIRS OF DIPOLE ELEMENTS AS REQUIRED
VARIABLE INDUCTANCE CONTROL
DIPOLE ANTENNA POSITION FOR VERTICAL POLARIZATION
KNOB FOR LOCKING ANTENNA AT SELECTED ANGLE OF POLARIZATION
PLANE OF DIPOLE
DIRECTION OF MAXIMUM PICK-UP
DIRECTIONAL CHARACTERISTICS OF ANY DIPOLE ANTENNA

Figure 4—10. Adjustment of Antenna AT-477/U (Low-frequency Dipole)

length dipole correction factors provided in Chart No. 5 are based on an antenna in horizontal position and at a height of 10 feet above ground.

The dipole antenna must also be adjusted to a position corresponding to the polarization of the received signal. Maximum pick-up of horizontally polarized waves is obtained with the dipole in a horizontal plane; of vertically polarized waves with the dipole in a vertical plane. Waves of mixed polarization can be received with the dipole tilted at some angle between the horizontal and the vertical.

The directional characteristics of a dipole antenna are such that a maximum pick-up is obtained when the dipole is broadside to the signal source. Minimum pick-up is obtained when the signal source is in line with the plane of the dipole.

After tuning the RI-FI Meter to the frequency of the signal under measurement, adjust the length of the dipole elements to correspond to that frequency. Alternately adjust the antenna for polarization and azimuth to obtain a maximum meter reading. Do not make a measurement at this time, for the maximum is broad. Turn the antenna in azimuth until an aural null is obtained.

Note

In the presence of a strong signal, the null will be difficult to obtain. Because sharpest nulls are obtained with the highest feasible attenuator setting, adjust the r-f attenuator control setting as necessary to reduce the signal. Use the indicating meter (M101) in conjunction with headphones to obtain the null indication when there is high acoustical noise at the survey site.

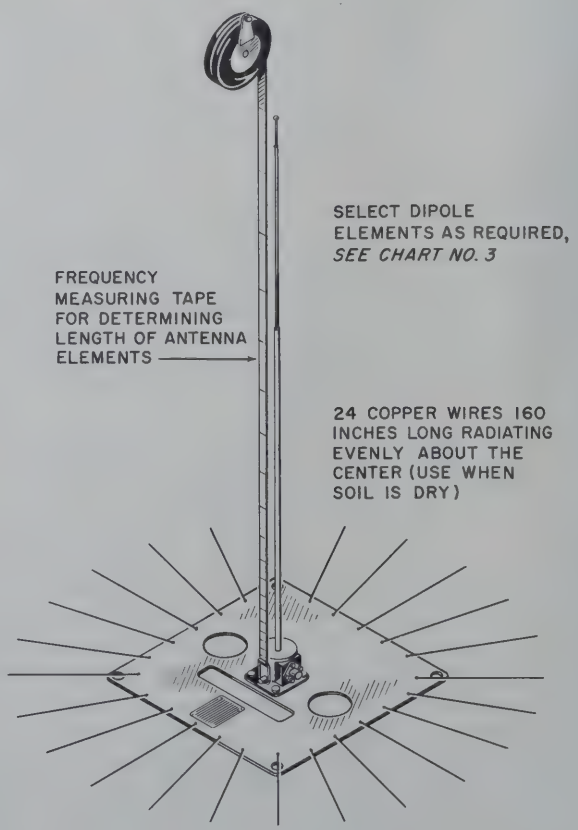

SELECT DIPOLE ELEMENTS AS REQUIRED, SEE CHART NO. 3
FREQUENCY MEASURING TAPE FOR DETERMINING LENGTH OF ANTENNA ELEMENTS
24 COPPER WIRES 160 INCHES LONG RADIATING EVENLY ABOUT THE CENTER (USE WHEN SOIL IS DRY)

Figure 4—11. Adjustment of Antenna Base AB-364/U (Ground Plane Vertical Antenna)

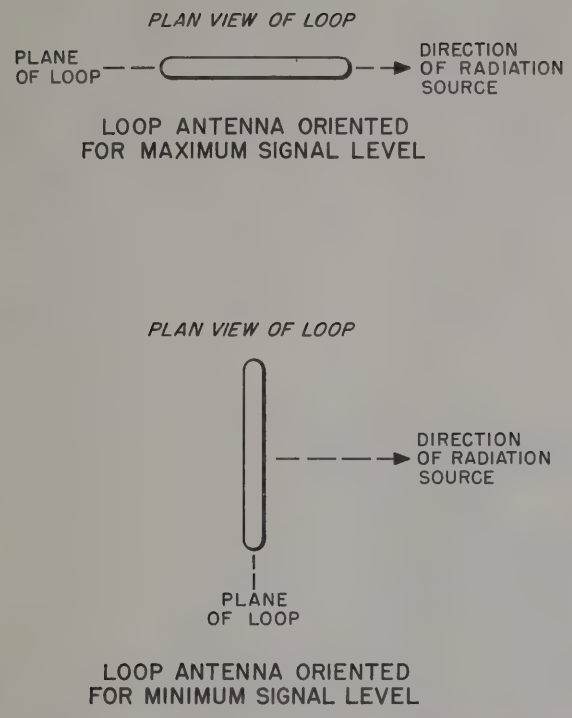

PLAN VIEW OF LOOP
PLANE OF LOOP
DIRECTION OF RADIATION SOURCE
LOOP ANTENNA ORIENTED FOR MAXIMUM SIGNAL LEVEL
PLAN VIEW OF LOOP
DIRECTION OF RADIATION SOURCE
PLANE OF LOOP
LOOP ANTENNA ORIENTED FOR MINIMUM SIGNAL LEVEL

Figure 4—12. Directional Characteristics of Antenna AT-426/U (Loop Antenna)

Upon obtaining the null indication, read the approximate magnetic bearing to the signal source, as indicated by the azimuth pointer and azimuth dial. (See Section 3, paragraph 6.*b*, for initial alignment of azimuth dial with respect to magnetic north.)

Note

For a more precise bearing, correct the magnetic bearing for the degree of variation at the geographical location of the survey site. Bear in mind that bilateral bearings are obtained with the antenna. The ambiguity must be resolved by triangulation.

Rotate the dipole exactly 90 degrees away from the null point, then make the measurement of the signal. This is required to give maximum signal input to the RI-FI Meter. If received signal is of mixed polarization, characterized by a poorly defined null point, any measurement of signal will be subjected to error.

c. USE OF VERTICAL ANTENNA.—A vertical antenna may be made from Antenna Base AB-364/U. This antenna is used as a self-resonant quarter-wave antenna in the frequency range 20 to 400 megacycles. See figure 4—11 and Chart No. 3 for illustration of vertical antenna adjustments. The end of Measuring Tape TL-635/U is attached to hook at the base of antenna and the length of the telescoping section is adjusted so the antenna tip corresponds to the operating frequency mark on the tape. To minimize error due to variations in soil conductivity, provisions are made for attaching a ground plane to the base. Vertical antenna correction factors provided in Chart No. 5 are based on the use of 24 copper wires 160 inches long attached to the antenna base and laid upon the ground, radiating evenly about the center. These wires are necessary when the antenna base is used on dry soil.

Field intensity measurements taken with a vertical antenna are subject to considerable error so include in the survey report a description of the site, topography, electrical properties of the ground, and the proximity of disturbing structures. Determine that only one cable is grounded in order to avoid a ground loop.

d. USE OF LOOP ANTENNA.—Antenna AT-426/U has a small diameter (three inches) because of the high frequencies at which it is used. As it is small in size, it has been insulated so that it may be used as a hand-held loop probe for close proximity search of sources of radiation energy. It can also be mounted on the antenna masts using the loop base supplied.

The loop antenna is used for field intensity and radio interference measurements, that is, for determining the bearing of a signal source and then measuring the strength of the signal. The directional characteristics of a loop are illustrated in figure 4—12.

Step 1. When the signal being measured is properly tuned in, rotate the loop to obtain an aural null.

Note

When a sharp null cannot be obtained because the signal is very strong, adjust the attenuator control setting as necessary to reduce the signal. Sharpest nulls are obtained with highest feasible attenuator setting. In the presence of high acoustical noise at the survey site, use the indicating meter (M101) in conjunction with headphones to obtain the null indication.

Step 2. Upon obtaining the null indication, read the approximate magnetic bearing to the signal source, as indicated by the azimuth pointer and azimuth dial. (See Section 3, paragraph 6.*b* for initial alignment of azimuth dial with respect to magnetic north.)

Note

For more precise bearing, correct the magnetic bearing for the degree of variation at the geographical location of the survey site. Bear in mind that bilateral bearings are obtained with this antenna. The ambiguity must be resolved by triangulation.

Step 3. Rotate the loop exactly 90 degrees away from the null point, then make the measurement of the signal. This is required to give maximum signal input to the RI-FI Meter.

Because of the small size of the loop and the frequencies involved, the loop correction factors provided for it in Chart No. 5 should be considered as approximate. If the received signal is other than vertically polarized, remove loop from mast adapter and rotate it in both vertical and horizontal planes for maximum

1 SET POWER SWITCH ON POWER SUPPLY PP-906/URM-47 TO ON; ALLOW 30 MINUTES WARM-UP PERIOD
3 PULL OUT, TURN TO CAL POSITION, PUSH ALL THE WAY IN
13 ADJUST AS NECESSARY TO KEEP METER POINTER ON UPPER PORTION OF SCALE IF POSSIBLE
14 READ AND COMPUTE VALUES OF MEASURED SIGNAL
7 ROTATE CLOCKWISE UNTIL PEAK LAMP GLOWS
8 ROTATE COUNTERCLOCKWISE UNTIL PEAK LAMP JUST CEASES TO GLOW
2 SET TO DESIRED FREQUENCY
6 ROTATE TO MAXIMUM COUNTER-CLOCKWISE POSITION
10 ROTATE CLOCKWISE UNTIL PEAK LAMP BLINKS IN STEP WITH CALIBRATOR PULSES
11 ROTATE COUNTERCLOCKWISE UNTIL PEAK LAMP JUST CEASES TO GLOW
4 TURN TO CAL POSITION
12 TURN TO THE DESIRED POSITION OF OPERATION
5 ROTATE FOR MAXIMUM METER INDICATION
9 ADJUST UNTIL METER READS CORRECT CALIBRATION VOLTAGE (IN DB) AS OBTAINED FROM FIRST PAGE OR FROM CHART NO.1 OR NO.2 OF CHART SET PT-188/URM-47 FOR THE DESIRED FREQUENCY.

Figure 4–13. Radio Interference-Field Intensity Meter IM-88/URM-47, Simplified Operating Procedure

reading. Approximate bearing readings, in this case, can best be done with a pocket compass. If received signal is of mixed polarization, characterized by a poorly defined null point, any reading will be subjected to error.

e. SIGNAL MEASUREMENT. *(See figure 4–13.)*

(1) STANDARDIZING GAIN.

Step 1. Turn POWER switch (S301) to ON. Set BAND SWITCH (G) and TUNING dial (H) to desired frequency.

Note

For best results, allow a 30-minute warm-up period after turning the power on. The power supply normally becomes warm during operation; do not regard it as an abnormal indication.

Step 2. Pull attenuator knob (A) out, turn to CAL position and push all the way in.

Note

The attenuator knob must always be pushed all the way in to avoid discontinuity at the coaxial connectors of the attenuator. Such discontinuity adversely affects the standing wave ratio and degrades the attenuation.

Step 3. Rotate function switch (B) to CAL position.

Step 4. Rotate PEAK control (C) to obtain approximately full-scale meter reading.

Step 5. Rotate CALIBRATE control (D) maximum counterclockwise.

Step 6. Adjust PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then rotate counterclockwise until the lamp just ceases to glow. The visual indication circuit is now at its most sensitive setting.

Step 7. Refer to the first page (introductory) of Chart Set PT-188/URM-47 (when measuring impulsive interference signals directly in terms of microvolts-per-kilocycle) or to Chart No. 1 or No. 2 (for all other measurements) and obtain the correct value of calibration voltage for standardizing at the desired frequency. This voltage is given in db. Adjust PEAK control (C) until indicating meter (M101) reads the correct calibration voltage on the decibel scale.

(Example: For a frequency of 27 megacycles, enter Chart No. 1 from the bottom at 27 megacycles on the Band 1 curve. (See sample Chart No. 1, figure 4–3.) Follow up to intersect the plotted curve. From the point of intersection follow to the left to find the calibration setting to be used, in this case 34.4 db. Adjust PEAK control knob (C) until meter reads the correct calibrating voltage on the db scale, in this example 34.4 db.)

– Step 8. Adjust the CALIBRATE control knob (D) clockwise until the PEAK indicator lamp blinks in step with calibrator pulses, then adjust counterclockwise until the indicator lamp just ceases to light. The RI-FI Meter gain is now standardized at this frequency. The CALIBRATE control (D) setting should not be changed until the RI-FI Meter is again standardized for gain at this or another frequency.

Note

Due to aging of tubes and other components, it may eventually become difficult at certain frequencies to calibrate the equipment properly using the figures given in the Chart Set because of insufficient CAL control range. In this case, it is still possible to calibrate the equipment quite accurately at reduced sensitivity. Accurate calibration is assured because of the constant output of the calibrator over long periods of time.

A new calibration figure (smaller than the original) may be arbitrarily selected. After making a measurement, the new calibration figure is simply subtracted from the figure given in the Chart Set and the difference applied to the meter reading of the signal under measurement. The procedure is as follows:

Rotate the CAL control fully clockwise.

Turn the PEAK control counterclockwise until the threshold is reached as indicated by flashing of the neon PEAK lamp.

Note the meter reading in db. This may be used as the new calibration figure.

Note the difference in db between this new calibration figure and that given on the calibration chart. Add this difference to the indicating meter reading of the signal.

For example, if the calibration figure is 25 db and this calibration cannot be made, rotate the PEAK control counterclockwise until the signal threshold is reached. Assume that at this point the indicating meter scale reads 20 db. Then, add 5 db to all signal measurements made at this frequency. Since signal measurements are usually read on the microvolt scale, the 5 db must be converted to a factor by which the microvolt reading can be multiplied. For example:

Assume a meter reading of 35 microvolts and a calibration setting difference of 5 db. The voltage ratio is:

$$5 \text{ db} = 1.78$$

Then, the corrected meter reading would be

$$1.78 \times 35 = 62.3 \text{ microvolts}$$

The db-voltage ratio relationship can be obtained from the conversion chart shown in figure 4–14.

Step 9. An alternate procedure for standardizing the gain of the RI-FI Meter is to use the "aural" method. Delete Steps 4, 5, and 6 above and use headphones to determine the point of signal cancellation by the "slide-back" bias (see subparagraph (2).(*b*), below). Because of variations in hearing ability between different operators, this method is not as consistent as the visual method. Also, this method cannot be used at locations where the acoustical noise level is high.

(2) PEAK or "SLIDE-BACK" OPERATION.—For measurements of the peak value of random or impulsive interference, the "slide-back" VTVM circuit is used.

Note

This equipment has been calibrated in terms of RMS of a sine wave (0.707 of true peak of a sine wave). The FI, QP and PEAK functions are adjusted to provide the same reading on an unmodulated sine wave signal. Peak values, hereafter referred to as effective peak values, are therefore in terms of RMS of a sine wave which would have the same peak amplitude as the signal that appears at the second detector input. Either visual or aural method can be used for measuring the signal.

First standardize the gain of the equipment at the test frequency as described in Steps 1 through 8 in subparagraph (1) above, then proceed as outlined below.

(*a*) VISUAL METHOD OF MEASUREMENT.

Step 1. Turn function switch (B) to PEAK.

Step 2. Turn PEAK control (C) to obtain approximately full-scale meter reading.

Step 3. Adjust attenuator (A) to CAL position by means of the PULL-TURN-PUSH sequence.

Step 4. Turn PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then rotate counterclockwise until the lamp just ceases to light. The visual indicating circuit is now at its most sensitive setting.

Step 5. Adjust attenuator control (A) by a PULL-TURN-PUSH sequence to select appropriate atten-

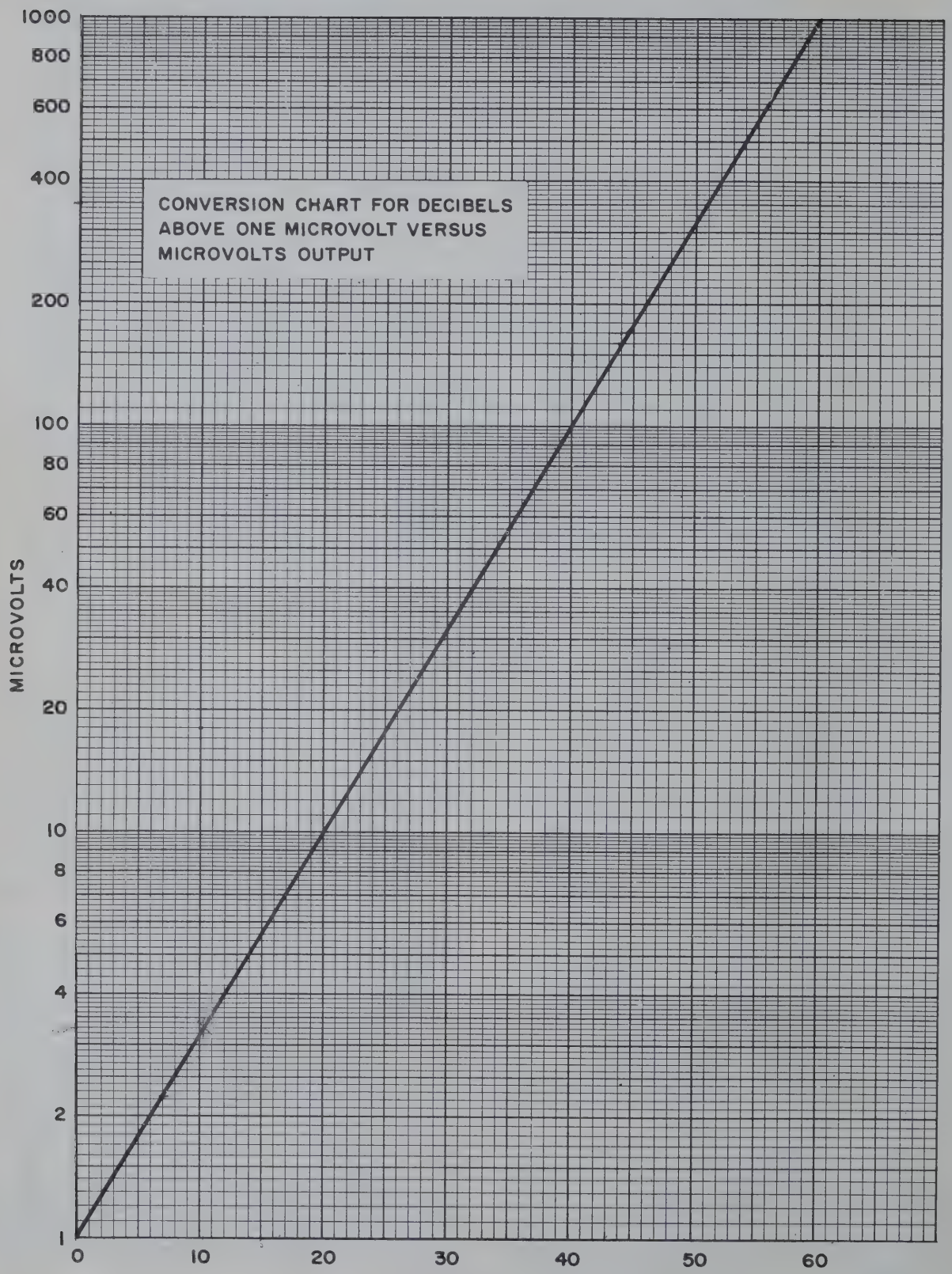


Figure 4–14. Conversion Chart for Decibels Above One Microvolt vs. Microvolts Output

uation that results in a final meter reading in the upper portion of scale where practicable.

Step 6. Turn PEAK control (C) counterclockwise until PEAK indicator lamp glows or blinks with signal modulation, then rotate clockwise until lamp just ceases to glow. Do not advance the PEAK control (C) beyond the threshold point or an erroneous meter indication will result. Observe the pointer of the indicating meter as the threshold point is approached. If the pointer goes off scale, advance the attenuator control (A) to next higher position and then readjust the PEAK control (C) to determine the threshold point.

Note

Take into account the slight delay in final meter (M101) indication after operation of the PEAK control.

Step 7. Read the indicating meter.

(*b*) AURAL METHOD OF MEASUREMENT.

Step 1. Turn function switch (B) to PEAK.

Step 2. Turn PEAK SENS. control (E) completely counterclockwise.

Step 3. Turn PEAK control (C) completely counterclockwise.

Step 4. Adjust position of attenuator control (A) by a PULL-TURN-PUSH sequence to select appropriate attenuation that results in a final meter reading in the upper portion of the scale where practicable.

Step 5. Adjust the AUDIO control (F) for a convenient headphone signal level. Slowly turn the PEAK control (C) clockwise until the received headphone signal just becomes inaudible. If necessary, advance AUDIO control (F) to a high level to facilitate establishment of this threshold point. Do not advance the PEAK control (C) beyond the point of inaudibility, or an erroneous meter indication will result. Observe the pointer of the indicating meter as the point of inaudibility is approached. If the pointer goes off scale, return PEAK control (C) to its fully counterclockwise position and advance the attenuator control to the next higher position. Then repeat the adjustment of PEAK and AUDIO controls to determine the point of inaudibility.

Note

Take into account the slight delay in final meter (M101) indication after operation of the PEAK control.

Step 6. Read the indicating meter.

(3) MEASURING SINE WAVE SIGNALS.

Step 1. Standardize the equipment gain at the test frequency as described in Steps 1 through 8 of subparagraph (1) above. Use CALIBRATION SETTINGS from Charts No. 1 or No. 2.

Step 2. Turn function switch (B) to FI for an RMS reading of a c-w signal or to QP or PEAK when carrier plus modulation is to be measured.

Step 3. Adjust position of the attenuator control (A) by the PULL-TURN-PUSH sequence until meter reads within meter scale range, preferably in the upper portion of the meter scale. Tune c-w signals for maximum meter reading.

Note

The signal should be close to the frequency of gain standardization, otherwise it will be necessary to standardize the gain at the new frequency before a measurement can be accurately made.

Step 4. Read the indicating meter in microvolts. Compute the value of the measured signal according to measuring modes given below.

(*a*) TWO-TERMINAL VOLTMETER.—Multiply the meter reading by correction factor from Charts No. 1 or No. 2 (No. 1 for first four bands, other factors for bands 5 and 6 depending on sensitivity). Multiply the product by the attenuator control setting.

(Example: Assume attenuator control setting is X10², meter scale indication is 20 microvolts and correction factor is 1. Then, 20 x 1 x 10² = 2000 microvolts across 50 ohms.)

(*b*) DIPOLE, LOOP, OR VERTICAL ANTENNA USED.—When a dipole, loop or vertical antenna is used, multiply the meter reading in microvolts by the correction factor from Charts No. 1 or No. 2. Multiply this product by the appropriate antenna factor on Charts No. 4 or No. 5. Multiply this product by the attenuator control setting.

(Example 1: Assume tuned dipole antenna is used, attenuator control setting is X10³, meter scale indication is 70 microvolts and frequency is 60 megacycles. Refer to sample Chart No. 4 (figure 4–5) for tuned dipole factors. Enter chart from the bottom at 60 megacycles, follow up to intersect the plotted curve. From the point of intersection, follow to the left to find the dipole factor to be used, in this case 3.05. The correction factor for Band 3 from sample Chart No. 1 (figure 4–3) is 1. Then, 70 x 1 x 3.05 x 10³ = 213,500 microvolts-per-meter.)

(Example 2: Assume vertical antenna in use, attenuator control setting is X10², meter scale indication is 40 microvolts and frequency is 180 megacycles. We find that the vertical antenna factor from sample Chart No. 5 (figure 4–5) for 180 megacycles is 10.0. The correction factor for Band 5 is 2. Then, 40 x 2 x 10 x 10² = 80,000 microvolts-per-meter.)

(4) MEASURING SINE WAVE SIGNALS WITH HIGH AMBIENT INTERFERENCE.—When a sine wave signal is being measured in the presence of high ambient interference of random nature, it is possible to correct for the interference and determine the actual intensity of the signal as though the random interference were not present. First, obtain the value of interference and signal combined. Then, obtain the value of

the ambient interference only. This measurement may be obtained by turning off the signal, if possible, or detuning the RI-FI Meter slightly. Monitor with headphones to determine how far to detune. When using the FIELD INTENSITY function, the step procedure is as follows:

Step 1. Standardize the gain of the equipment.

Step 2. Set function switch to FI position.

Step 3. Note the meter reading of the random interference in the absence of signal. If necessary, detune slightly off signal.

Step 4. Tune in signal and note meter reading of signal and random interference combined.

Step 5. In sample Chart No. 8 (figure 4–7) locate the meter reading of "interference plus signal" on horizontal scale of chart.

(*Example: Assume 55 microvolts.*)

Step 6. Follow the arc upward until it intersects the horizontal line which represents the "interference only" meter reading.

(*Example: Assume 34 microvolts.*)

Step 7. Drop down from the point of intersection to the horizontal scale and read off the corrected meter reading. This is the value of the signal in the absence of the random interference.

(*Example: 43 microvolts.*)

Step 8. When using the QUASI PEAK function, subtract the value of "interference only" obtained in Step 6 above directly from the value of interference and signal combined. (See Interference Plus Signal Chart, paragraph 7.*b.*(3).(*d*).)

(5) MEASURING RANDOM INTERFERENCE.

Step 1. Standardize the equipment gain at the test frequency as described in Steps 1 through 8 of subparagraph (1) above. Use CALIBRATION SETTINGS from Charts No. 1 or No. 2.

Step 2. Rotate function switch (B) to FI for an equivalent RMS reading of random interference, to QP for a "nuisance" value reading, and to PEAK for a peak value reading.

Step 3. Adjust position of the attenuator control (A) by the PULL-TURN-PUSH sequence until meter reads within the meter scale range, preferably in the upper portion of the meter scale.

Step 4. Read indicating meter in microvolts. Compute the value of the measured signal in the same manner as in subparagraphs (3).(*a*) and (3).(*b*) above for sine wave signals.

Step 5. To obtain per-kilocycle values, divide the computed values obtained by Step 4 above by the square root of the effective "random interference" bandwidth. Refer to Charts No. 6 and No. 7 for the bandwidth data. The square root can be read directly from the top of Chart No. 9.

(*Example 1: Assume attenuator setting is X10, meter scale indication is 35 microvolts, correction factor is 1 and the effective "random interference" bandwidth is 132 kc. Refer to sample Chart No. 9 (figure 4–8). Enter chart on upper scale at 132 kc. The square root value of 11.5 will be found directly below on the lower scale. Then:*

$$\frac{10 \times 35 \times 1}{11.5} = 30.43$$ *microvolts-per-meter-per-kilocycle across 50 ohms.)*

(*Example 2: Assume a tuned dipole in use, attenuator control setting is X10², meter scale indication is 70 microvolts and frequency is 116 megacycles. We find that the antenna factor from sample Chart No. 4 for 116 megacycles is 3.1. The correction factor for Band 4 is 1. The effective "random interference" bandwidth from sample Chart No. 7 for 116 megacycles is 116 kilocycles. From Chart No. 9 the square root of 116 is 10.77. Then:*

$$\frac{10^2 \times 70 \times 1 \times 3.1}{10.77} = 2014.9$$ *microvolts-per-meter-per-kilocycle.)*

(6) MEASURING IMPULSIVE INTERFERENCE SIGNALS.—Two methods of impulsive interference signal measurements are available to the operator of the AN/URM-47. The method described first gives the final peak value of a conducted signal in microvolts-per-kilocycle across 50 ohms. The second method presents the final peak value in decibels above one microvolt-per-megacycle across 50 ohms.

(*a*) METHOD NO. 1.

Step 1. Standardize the equipment gain at the test frequency as described in Steps 1 through 8 of subparagraph (1) above. Use the CALIBRATION SETTING given on the first introductory page of the Chart Set. This setting is in db and is for use with Cable Assembly CG-92D/U (20′ 0″).

Step 2. Take a PEAK or "slide-back" measurement of the impulsive interference signal. Use either visual or aural method of measurement. This meter reading is equivalent to a bias voltage (introduced by the PEAK control) that is identical to the effective peak value of the input signal as seen by the second detector.

Step 3. For conducted measurements, mentally *divide* the indicated reading (meter scale reading times the attenuator setting) by a *bandwidth* factor of 100 to obtain the final peak value (see note in subparagraph (2) above) of conducted signal in microvolts-per-kilocycle across 50 ohms.

Note

The amplitude of a pulse signal that appears at the second detector is directly proportional to the effective impulsive interference bandwidth. To the closest decimal point, the bandwidth of the equipment is 100 times greater than 1 kc.

Step 4. When measuring field intensity with a pick-up device, mentally *divide* the indicated meter read-

ing (meter scale reading times the attenuator setting) by a bandwidth factor of 100 to obtain a value of microvolts-per-kilocycle. Multiply this quantity by the appropriate antenna factor from Charts No. 4 and No. 5. This result will be the final peak value (see note in subparagraph (2) above) of field intensity in microvolts-per-meter-per-kilocycle.

Step 5. When using the CALIBRATION SETTINGS provided on Charts No. 1 and No. 2, the r-f cable losses are compensated. With a single CALIBRATION SETTING, obtained from the first page of Chart Set PT-188/URM-47, the r-f cable losses are compensated for at only one frequency, 125 megacycles. A maximum error of four per cent occurs at either end of the frequency range. If greater accuracy is desired, r-f cable losses must be taken into account. Multiply the final values of Steps 3 and 4 above by the appropriate correction factor from Chart No. 9 (see figure 4–8) to obtain final corrected values. When using a short r-f cable, no correction for attenuation losses is necessary. However, a calibration setting 0.5 db less than that appearing on the first page of the Chart Set must be used.

(Example 1: Assume a fixed-length dipole in use, attenuator control setting is X10, correction factor is 1, frequency is 26 megacycles and meter indication is 40 microvolts. From sample Chart No. 5 (figure 4–5), the fixed length dipole factor is 2.9. Then:

$$\frac{10 \times 1 \times 40 \times 2.9}{100} = 11.6 \text{ microvolts-per-meter-per-kilocycle.}$$

For greater accuracy when using Cable Assembly CG-92D/U (20′ 0″), multiply by the correction factor from Chart No. 9 (figure 4–8). Enter chart from the bottom at 26 megacycles, follow up to intersect the plotted curve. From point of intersection, follow to the left to find the correction factor to be used, in this case 0.963. Then:

$$11.6 \times 0.963 = 11.17 \text{ microvolts-per-meter-per-kilocycle.)}$$

(Example 2: Assume a loop antenna in use, attenuator control setting is X10², frequency is 330 megacycles and a meter indication of 70 microvolts. The correction factor for Band 6, at 330 megacycles, from sample Chart No. 2 (figure 4–3) is 3.5. From sample Chart No. 5 (figure 4–5), the loop antenna factor is 120. Then:

$$\frac{100 \times 70 \times 3.5 \times 120}{100} = 29{,}400 \text{ microvolts-per-meter-per-kilocycle.}$$

For greater accuracy when using Cable Assembly CG-92D/U (20′ 0″), multiply by the correction factor for cable loss. From sample Chart No. 9 (figure 4–8), the corrected factor is 1.0341. Then:

$$29{,}400 \times 1.0341 = 30{,}605 \text{ microvolts-per-meter-per-kilocycle.)}$$

(*b*) METHOD NO. 2.

Step 1. Standardize the equipment gain at the test frequency as described in Steps 1 through 8 of subparagraph (1) above. Use the CALIBRATION SETTING given on the first page of the Chart Set. This setting is in db and is for use with Cable Assembly CG-92D/U (20′ 0″).

Step 2. Take a PEAK or "slide-back" measurement of the impulsive interference signal. Use either visual or aural method of measurement. This meter reading is equivalent to a bias voltage (introduced by the PEAK control) that is identical to the effective peak value of the input signal as seen by the second detector.

Step 3. For conductive measurements, mentally add 20 db to the indicated reading (meter reading in db plus the attenuator setting in db) to obtain the final peak value of conducted signal in db above one microvolt-per-megacycle across 50 ohms.

Note

The amplitude of a pulse signal that appears at the second detector is directly proportional to the impulsive interference bandwidth. To the closest decimal point, the bandwidth of the AN/URM-47 equipment is 1/10 megacycle.

Step 4. When measuring field intensity with a pick-up device, mentally add 20 db to the indicated reading (meter scale reading in db plus attenuator setting in db) to obtain a value of db above 1 microvolt-per-megacycle. Add to this quantity the appropriate db equivalent of the antenna factor. This may be obtained by applying the factor taken from Charts No. 4 and No. 5 to the conversion chart (see figure 4–14). This result will be the final peak value of field intensity in db above 1 microvolt-per-megacycle-per-meter.

Step 5. When using a 20-foot r-f cable and the CALIBRATION SETTING on page one of the Chart Set, the cable attenuation is only compensated for at 125 megacycles. A maximum error of 4 per cent occurs at either end of the frequency range. If greater accuracy is desired, these r-f cable losses must be taken into account. Add to the final values of Steps 3 and 4 above the appropriate correction in db from Chart No. 9 (see figure 4–8) to obtain final corrected values. When using a short r-f cable, no correction for attenuation losses is necessary. However, a calibration setting of 0.5 db less than that appearing on the first page of the Chart Set must be used.

(Example 1: As a two-terminal voltmeter, assume a meter scale reading of 32 db, an attenuator setting of +40 db, and a frequency of 200 megacycles. Then the conducted signal will be:

$$32 \text{ db} + 40 \text{ db} + 20 \text{ db} = 92 \text{ db above 1 microvolt-per-megacycle across 50 ohms.}$$

For greater accuracy when using Cable Assembly CG-92D/U (20′ 0″), add correction in db from Chart No. 9 (see figure 4–8). Enter chart from the bottom at 200 megacycles, follow up to intersect the plotted curve. From point of intersection with curve, follow to the right to find the correction in db to be used, in this case 0.14, then:

92 db + 0.14 db = 92.14 db above 1 microvolt-per-megacycle across 50 ohms.)

(Example 2: Assume a tuned dipole antenna in use, a frequency of 65 megacycles, a meter scale reading of 37 db and an attenuator setting of +20 db. Then:

37 db + 20 db + 20 db = 77 db above 1 microvolt-per-megacycle.

From Chart No. 4, the antenna factor is 3.3; this in db is 10.4 (see conversion chart, figure 4–14). Then the field intensity will be:

77 db + 10.4 db = 87.4 db above 1 microvolt-per-meter-per-megacycle.

For greater accuracy when using the 20-foot r-f cable, add correction in db from Chart No. 9 (see figure 4–8), thus:

87.4 db — 0.18 db = 87.22 db above 1 microvolt-per-meter-per-megacycle.)

f. VISUAL MONITORING OF SIGNAL.—Visual observation of interference signals and modulation components can be made by connecting an oscilloscope to receptacle J107. Use Cable Assembly CG-573/U (3′ 0″). The equipment is capable of an overall frequency response of 20 to 100,000 cycles within ±3 db. This includes the input capacitance of the oscilloscope if not too high. For best results, use the FIELD INTENSITY position of the function switch (B). Rotate the AUDIO control (F) to its maximum counterclockwise position. This position removes V114 grid loading from the plate circuit of V113 and improves the high-frequency response of the signal available at receptacle J107.

Note

An oscilloscope, such as the OS-8/U or equivalent, can be used in the FIELD INTENSITY and PEAK function switch positions. In the FIELD INTENSITY position, the oscilloscope is used for observing the modulation envelope of continuous wave signals or of radio interference. It can also be used to determine the repetition rate of pulse-type interference. In the PEAK position, the oscilloscope can be used as a visual null indicator when used in conjunction with the PEAK control.

5. SUMMARY OF OPERATION.

This summary of Radio Interference Measuring Set AN/URM-47 operation is the same as that given on the first two introductory sheets of Chart Set PT-188/URM-47. This Chart Set is normally carried inside the panel-protective cover on the Radio Interference-Field Intensity Meter IM-88/URM-47. An extra Chart Set is provided inside the metering unit.

a. The word "signal" is used to designate any r-f input to the equipment, i.e., sine wave, random interference or impulsive interference. Signal inputs to the equipment are of two types. The first includes the use of the equipment as a two-terminal voltmeter, in making conducted measurements, by direct connection of the 20-foot r-f input line to a 50-ohm coaxial circuit. If impedances other than 50 ohms are connected to the input, the meter readings will be relative, not actual values. Conductive measurements on lines carrying a-c or d-c voltages up to 1000 volts peak may be made.

The second type input is as a field intensity meter using dipole, rod, or loop antennas as calibrated pick-up devices. Field intensity measurements are made with antenna rotated for maximum response in the plane of polarization desired. Adjust antenna length within ±1/8 in. of calibration on frequency measuring tape for most accurate results. (See Chart No. 3.)

The information presented in the Chart Set is valid only when measurements are taken using the 20-foot r-f transmission line CG-920/U. On conductive measurements it is assumed that the device being tested presents a carefully matched 50-ohm input to the equipment.

b. ADJUSTING EQUIPMENT FOR STANDARD GAIN.

Step 1. Set BAND switch (G) and TUNE dial (H) to desired frequency.

Step 2. PULL attenuator knob (A) out, TURN to CAL position, PUSH all the way in.

Step 3. Rotate FUNCTION switch (B) to CAL.

Step 4. Rotate PEAK control (C) to obtain approximate full peak meter reading.

Step 5. Rotate CAL control (D) maximum counterclockwise.

Step 6. Adjust PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then rotate counterclockwise until the lamp just ceases to light.

Step 7. Rotate PEAK control (C) for an output meter indication equal to the CALIBRATION SETTING for the desired frequency as provided on Charts No. 1 and No. 2. When measuring impulsive interference directly in terms of microvolts-per-kilocycle, use CALIBRATION SETTING of ___ db throughout the frequency range (consult chart of particular equipment for the value of db required).

Step 8. Adjust CAL control (D) clockwise until PEAK indicator lamp blinks in step with calibrator pulses, then adjust counterclockwise until lamp just ceases to light.

Step 9. The equipment is now adjusted for standard gain. The CAL control (D) setting should not be changed until the RI-FI Meter is again standardized for gain at this or another frequency.

c. PEAK OR "SLIDE-BACK" OPERATION.

Step 1. PULL-TURN-PUSH attenuator knob (A) to CAL position.

Step 2. Rotate function switch (B) to PEAK.

Step 3. Rotate PEAK control (C) to obtain approximate full scale meter reading.

Step 4. Adjust PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then slowly rotate

counterclockwise until the lamp just ceases to light.

Step 5. PULL-TURN-PUSH attenuator knob (A) to appropriate step (X1 through $X10^4$).

Step 6. Slowly adjust PEAK control (C) until interference just fails to be visible on the PEAK lamp. The lamp will cease to light at this point, indicating that the signal threshold has been reached. Adjust attenuator as required. Adjust PEAK control carefully back and forth at the threshold point for improved accuracy. Take into account the slight lag in the effect of the control. The meter reads a bias (introduced by the PEAK control) which is identical to the peak value of the signal.

Note

This equipment has been calibrated in terms of RMS of a sine wave (0.707 of true peak of a sine wave). Peak values are therefore in terms of RMS of a sine wave which would have the same peak amplitude as the signal that appears at the second detector input.

d. MEASURING SINE WAVE SIGNALS.

Step 1. Standardize the gain of the equipment at the desired frequency.

Step 2. Rotate FUNCTION switch (B) to FI for an RMS reading of c-w signals or to QP or PEAK when carrier plus modulation is to be measured.

Step 3. PULL-TURN-PUSH attenuator knob (A) to select appropriate attenuation for meter reading in upper portion of the scale, where possible.

Step 4. Multiply meter reading in microvolts by an appropriate correction factor from Charts No. 1 and No. 2. Where a pick-up device is used, multiply the corrected meter reading by appropriate antenna factor from Charts No. 4 and No. 5. Multiply the result by attenuator setting to obtain final corrected values.

Step 5. When a sine wave signal is being measured in the FI function in the presence of high ambient interference of random nature, it is possible to correct for the interference and determine the actual value of the signal as though interference were not present. Refer to Chart No. 8. Also refer to INTERFERENCE PLUS SIGNAL CHART, Section 4, paragraph 7.*b.*(3).(*d*) of this instruction book.

e. MEASURING RANDOM INTERFERENCE SIGNALS.

Step 1. Standardize the gain of the equipment at the desired frequency.

Step 2. Rotate FUNCTION switch (B) to FI for an equivalent RMS reading of a random interference signal, to QP for a "nuisance" value reading and to PEAK for a peak value reading (see note, subparagraph *c* above).

Step 3. PULL-TURN-PUSH attenuator knob (A) to select appropriate attenuation for meter reading in upper portion of the scale, where possible.

Step 4. Multiply meter reading in microvolts by appropriate correction factor from Charts No. 1 and No. 2. Where a pick-up device is used, multiply the corrected meter reading by appropriate antenna factor from Charts No. 4 and No. 5. Multiply the result by attenuator setting to obtain final corrected values.

Step 5. To obtain per-kilocycle values, divide corrected values from Step 4 by the square root of the effective "random interference" bandwidth. Refer to Charts No. 6 and No. 7 for bandwidth data. The square root can be read directly from Chart No. 9.

f. MEASURING IMPULSIVE INTERFERENCE SIGNALS.

(1) METHOD NO. 1.

Step 1. Standardize the gain of the equipment at the desired frequency.

Step 2. Readjust PEAK SENS. control (E), if required:

(*a*) Adjust attenuator knob (A) to CAL position. Rotate FUNCTION switch (B) to peak position.

(*b*) Rotate PEAK control (C) to obtain approximate full scale meter reading.

(*c*) Adjust PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then slowly rotate counterclockwise until lamp just ceases to light.

Step 3. PULL-TURN-PUSH attenuator knob (A) to appropriate step (X1 through $X10^4$).

Step 4. Slowly adjust PEAK control (C) until interference just ceases to be visible on the PEAK lamp or heard in the headphones. The lamp will cease to light at this point and the interference will not be heard in the headphones, indicating that the signal threshold has been reached. Adjust attenuator as required. Adjust PEAK control carefully back and forth at the threshold point for improved accuracy.

Step 5. For conductive measurements, multiply the meter reading in microvolts by the attenuator setting and divide by 100 to obtain final peak value in microvolts-per-kilocycle (see note, subparagraph *c*, above).

Step 6. Where a pick-up device is used, multiply the meter reading in microvolts by the attenuator setting and by the appropriate antenna factor from Charts No. 4 and No. 5. Divide the result by 100 to obtain final peak values (see note, subparagraph *c*, above) in microvolts-per-meter-per-kilocycle.

Step 7. If greater accuracy is desired, r-f cable losses must be taken into account. Multiply the final values of Steps 5 and 6 by the appropriate correction factor from Chart No. 9 to obtain final corrected values.

(2) METHOD NO. 2.

Step 1. Standardize the gain of the equipment at the desired frequency.

Step 2. Readjust PEAK SENS. control (E), if required.

(*a*) Leave attenuator knob (A) in CAL position. Rotate function switch to PEAK position.

(*b*) Rotate PEAK control (C) to obtain approximate full scale meter reading.

(*c*) Adjust PEAK SENS. control (E) clockwise until PEAK indicator lamp glows, then slowly rotate counterclockwise until the lamp just ceases to light.

Step 3. PULL-TURN-PUSH attenuator knob (A) to appropriate step (0 through +80 db).

Step 4. Slowly adjust PEAK control (C) until interference just ceases to be visible on lamp or heard in headphones. Adjust attenuator as required. Adjust PEAK control carefully back and forth at the threshold point for improved accuracy.

Step 5. For conductive measurements, add 20 db to the meter scale reading in db plus the attenuator setting in db to obtain final peak value of conducted signal in db above 1 microvolt-per-megacycle.

6. USE AS A SENSITIVE TWO-TERMINAL RADIO FREQUENCY VOLTMETER.

Radio Interference-Field Intensity Meter IM-88/URM-47 is a selective highly-sensitive two-terminal voltmeter. By considering the applications carefully it can be used as listed below:

a. It can be used as a null instrument in conjunction with r-f bridges and slotted lines suitable for operation in the 20- to 400-megacycle frequency range. Extremely short leads, preferably shielded, must be used and extreme care must be taken to assure proper impedance matches.

b. It can be used to measure the gain of a radio-frequency stage in radio equipment by measuring the voltage input to the stage and the signal output of the stage. It should be noted that the RI-FI Meter shunts approximately 50 ohms across the circuit and may upset the stage under test unless appropriately isolated.

c. It can be used to check the voltage of any 50-ohm transmission line up to one volt, provided the transmission line is properly terminated.

Note

The voltage rating (d-c or a-c power frequencies) that may be applied to the input without damage to input circuits is 1000 volts.

d. It can be used to determine the loss in a coaxial line connected to a signal generator by comparing the signal level at the input and output ends of the line. The appropriate impedance matching network must be used between the line and the RI-FI Meter. To minimize the effects of standing waves, the higher attenuator positions of $X10^2$, $X10^3$ and $X10^4$ should be used when practicable.

7. SURVEY CONSIDERATIONS.

a. FIELD INTENSITY CONSIDERATIONS.—A knowledge of the fundamentals of wave propagation is essential in order to conduct field intensity surveys properly. The study of wave propagation is highly complicated by the large number of variable factors that must be considered and by the interpretation of the results of a series of measurements. This section of the instruction book contains a brief description of some of these factors as they apply to the frequency range covered by Radio Interference Measuring Set AN/URM-47.

To secure meaningful and interpretable results, a field intensity survey must be well planned. The necessary schedules should be arranged and co-ordinated with all participating units and personnel well in advance of the date of the tests. Adequate spare parts and supplies should be available, especially if the project is such that it may be impossible to obtain repeat transmissions. It is a good plan to carry duplicate equipments for such a project, when possible.

If measurements are to be continued away from the base station over a period of several days, a check-off list of accessories to be taken along should be carefully prepared. Such a list would include items such as data sheets, recorders, recorder charts and ink, pencils, flash lamps, spare batteries, wire, electronic repair kit, multimeter, battery clips, road maps, topographical charts, compass, slide rule, thermos bottles, adequate clothing, sleeping facilities, toilet articles, first aid kit, paper towels, hand axe, power supply spares, necessary accessories and spares for the vehicle, arrangements for obtaining gas and oil, spare vehicle keys, food and water, etc.

Because of the difference in the manner in which field intensity surveys and radio interference surveys are conducted, each will be treated separately.

(1) SELECTING THE SITE FOR FIELD INTENSITY MEASUREMENTS.—It is sometimes necessary to make field intensity measurements at a designated location, and it is then essential to consider the effect of surrounding objects on the received signal strength. Often, however, the measurement location can be selected, and the observer must then know what constitutes a good site for a given set of conditions. True radiation field measurements are made at distances greater than about two wavelengths from the transmitter in order to avoid the influence of the induction field.

In selecting a site for field intensity measurement, the following considerations should be kept in mind: The radio-frequency voltage induced in a receiving antenna is proportional to the intensity of the electromagnetic field in the space occupied by the antenna. The intensity at this point will depend upon the radiated power; the frequency of the received signal; the distance from the transmitter; the attenuation over the path between the transmitter and the receiver; reflections and re-radiations from nearby conductors, such as power lines, wire fences, and steel buildings; absorption by trees; and the effects of hill, gullies, or cliffs.

The ideal site would be an open, flat terrain at a considerable distance (1000 feet or more) from buildings, electric lines, fences, etc. Ideal sites are rare in the more populated sections of the country; therefore, it is good practice to check a proposed location by making measurements of the desired signal at several points in the vicinity. If the same value of field intensity is obtained at each of the points any one may be considered satis-

factory. If it is necessary to use an unsatisfactory site, a series of readings should be recorded at a number of different points in the neighborhood of the selected site, and detailed notes on the site conditions should be appended to the recorded data.

There are no fixed rules to govern the minimum distance between the field intensity measuring equipment and the nearest wire lines or other disturbing object because possible resonances are unpredictable. Another consideration in site selection is the possible presence of local electrical interference sources which may make field intensity measurements difficult.

If measurements are to be made with the equipment mounted in a vehicle, it will be necessary to determine the effect of the vehicle on the received signal. This is done by measuring a signal with the equipment mounted in the vehicle as it is to be used and again with it temporarily located some distance away from the vehicle. If differences are noted, measurements should be taken with the vehicle heading changed 15 or 20 degrees at a time. The differences between the readings taken in the vehicle and those taken outside the vehicle are then plotted in percentages of the outside readings versus heading. A different curve will generally be needed for each operating frequency. A calibration of this type is facilitated by simultaneously using two similar equipments, one equipment set up in the open and the other mounted in the vehicle and operated 50 to 75 feet away from the former.

(2) PROPAGATION CHARACTERISTICS FOR HIGH FREQUENCIES AND ULTRA-HIGH FREQUENCIES.—The propagation description will be presented in two parts: (*a*) for frequency range where sky-wave energy is reflected back to earth (20 to 35 megacycles); and (*b*) for frequency range where no sky-wave energy is reflected back to earth (above 35 megacycles).

(*a*) The relationship of the "sky wave" and the "ground wave" and the factors affecting them are discussed briefly below.

When measuring field intensities at high frequencies, there are two major factors to consider. The more important of these factors is the distance of the measuring site from the transmitting antenna. There is an area wherein the ground wave of the transmitting antenna is too weak to be detected and the sky wave is not present, dependent upon the angle of radiation from transmitting antenna and the angle of reflection of the transmitted signal from the ionosphere. This area, at a distance from the transmitting station, depending upon the transmitting frequency, is called the "skip distance". The extent of this area is dependent to a great degree upon the conditions of the ionosphere at the time of measurement. Therefore, *the distance of the recording site from the transmitting antenna and the exact time of measurements are very important.*

The next factor of importance is the varying conditions due to ionospheric changes and is described by a condition which is known as night and dawn effect. This effect is due, primarily, to changes in the ionosphere. At, or shortly after sunset, and just before dawn, considerable changes occur in the ionosphere. It is due to these disturbances that large variations in measured field intensities occur. The higher the frequencies, the greater the effect of these disturbances.

Abnormal propagation conditions may be attributed to magnetic or ionospheric storms. During ionospheric storms, the high frequencies are subject to very erratic changes and a large part of the spectrum above 2000 kilocycles may be entirely "blacked out". Abnormal propagation conditions cause the measured field intensity values to be higher or lower than would be obtained under normal conditions. An alert operator should be able to recognize these abnormal conditions so that proper notes may be entered in the measurement data.

(*b*) Propagation of high-frequency waves above 35 megacycles is similar to propagation of light waves in that the transmission is line-of-sight and is affected by reflection and refraction. In general, the receiving antenna must be in an unobstructed line with the transmitting antenna.

If a transmission path lies near a reflecting surface, the energy picked up by the receiver antenna is made up of two components, one received directly from the transmitter antenna and the second reflected from the earth. The resultant of the direct and the reflected wave will depend not only on the difference in the length of the two paths but upon changes of phase or intensity introduced in the process of reflection. These phase or intensity changes result in breaking up the transmitted energy pattern into a lobe structure (not to be confused with polar plot of antenna directional characteristics). The longer the wavelength, the higher the lowest lobe is tilted upward from the surface of the earth. Hence, the energy received in an aircraft will be determined by its position relative to the maximum and minimum points of the lobe pattern.

Transmission in these frequencies is affected by refraction, the refraction resulting from vertical temperature gradients. For example, when land is heated by the sun and cools by radiation at night, a thin layer of dense cool air is formed just above the ground, resulting in a rapid decrease of refractive index with height. Refraction causes the transmitted wave to bend slightly in conformation with the contour of the earth.

A more widespread cause of strong vertical gradients in refraction index, and therefore of excessive bending of transmitted energy, is the refractive effect of water vapor. Over most of the surface of the ocean, the region above the water is not saturated with water vapor, whereas the layer directly in contact with the water must be very nearly saturated. There is a continual evaporation of water from the sea and a diffusion of the vapor upward into the overlying air mass. Thus, there exists a vertical gradient in the concentration of water vapor with the highest concentration at the surface and decreasing upward. This tends to form a duct in which the transmitted wave curves to follow a direct path as if it were enclosed in a huge waveguide.

The average or standard refraction effect of the atmosphere may be taken into account by assuming that the earth has a radius 4/3 times its actual value, and by computing geometrical horizon ranges on this assumption. When this is done the horizon will be at a distance r from a point at height h above a spherical earth given by

$$r = 1.22\sqrt{h}$$

where h is in feet and r is in nautical miles; or by

$$R = \sqrt{2h}$$

where R is in land miles and h in feet.

The radio horizon distance between a point at h_1, and another at height h_2 is

$$r = 1.22\sqrt{h_1} \quad + \quad 1.22\sqrt{h_2}$$

The importance of antenna elevation for line-of-sight transmission in this frequency band is emphasized by the square root dependence in the above formula.

(3) RECORDING OF OBSERVED DATA.—In addition to correct operating procedures described elsewhere in this instruction book, it is essential that data records be very complete so that the results of a survey may be properly interpreted and evaluated by interested personnel.

When graphic records are made, each recorder chart must be carefully identified and complete information supplied for each series of measurements. This information should include the date, start and finish time, the test identification, the location (very carefully described as to geographical position and to presence of disturbing objects), description of weather conditions, the equipment used, the measurement frequency, the calibration, the attenuator setting, the function switch position, the antenna used, the chart speed, erratic conditions, and non-opposite minima. A convenient form for entering data on a recorder chart is as follows:

Date _____

TEST _____

LOCATION _____

_____ (use additional space for complete

description) _____

Equipment _____ Ser. # _____

Freq. _____ Calibration _____

Atten. Setting _____ Function-sw _____

Antenna _____

Height above ground _____

Ground _____

Recorder Ser. # _____ Chart speed _____

Time: start _____ stop _____

Observers _____

Notes: _____

When graphic recording is not employed, the same information should be entered on a form such as that shown in tables 4–3 or 4–4 and 4–5. Some of the data may appear to be superfluous at the time of observation, but it is often invaluable when trying to interpret results at a later date. A separate record sheet or graphic record chart should be used for each measurement location.

A sample description of a measurement site is as follows:

Site No. 21—10.14 miles north of Riverside, California, State Route 13 (0.19 miles south of intersection with State Route 5), 210 feet east of highway in open field; grove of trees approximately 150 feet high lies 900 feet northeast of site; nearest wire lines 300 feet east, running north and south; nearest wire fence 120 feet south, running east and west, terrain slightly rolling; check showed uniform field conditions.

In the "Remarks" column of the data sheet, enter all pertinent information such as height of antenna, weather and atmospheric conditions, poor minima, local interference, fluctuations in signal strength, antenna current if known, operational difficulties, and any other data that may be useful.

The observed field intensity may be measured and listed in either microvolts-per-meter or in decibels above one microvolt-per-meter. It is sometimes desirable, however, to be able to convert from one to the other. The following formula may be used for this purpose:

FI decibels above 1 microvolt-per-meter = 20 x $\log_{10}$ FI microvolts-per-meter.

b. RADIO INTERFERENCE CONSIDERATIONS.

(1) SELECTING THE SITE FOR GENERAL INTERFERENCE SURVEYS.—An open flat terrain is preferred to preclude absorption by dense growths of trees and steep ridges. Also, the face of a nearby cliff may act as a reflector and produce local variations in the intensity of interference measured.

In order to isolate the radiated field from the induction field of a source of interference, radio interference measurements of a radiating source should be made at distances greater than twice the wavelengths of the radiated energy.

In general, interference surveys made in the vicinity of power lines are subject to inaccurate results because of possible reradiation from the power lines and because it is necessary to measure at considerable distance from the power lines. Every attempt should be made to avoid locating the equipment near closed loops present in iron-framed buildings and topside structures aboard ship. If possible, avoid locations in the vicinity of underground pipes, trolley cables, or rail lines.

When the equipment is installed in a vehicle, it should be remembered that the metal body and frame of the vehicle tend to distort the pick-up pattern of the dipole antenna. In addition, closed loops formed by vehicle

TABLE 4–3. FIELD INTENSITY DATA RECORD SHEET

Date ..... Transmitting station .....

Radio Interference Measuring Set AN/URM-47, Ser. No. ..... Meas. Site .....

[On back of this sheet, list all pertinent site data as suggested in pargaraph 7.*a.* (3)]

Observers .....

..... Distance from trans. ..... naut. mi. .....

stat. mi. .....

.....

.....

1	2	3	4	5	6	7		8
TIME	FREQ	IND μv	ATT SET	CORR FACT	PICK-UP	FIELD INTENSITY μv/m	db	REMARKS

Notes: (1) Col. 3 is indicated microvolts on the RI-FI Meter.
Col. 4 is attenuator setting of RI-FI Meter.
Col. 5 is the correction factor of the RI-FI Meter.
Col. 6 is the type of pick-up, loop or dipole antenna.
Col. 7 is the resultant field intensity.

$\mu v/m$ = Col. 3 x Col. 4 x Col. 5
$(db) = 20 \times \log_{10} (\mu v/m)$

Col. 8 is for notes on weather conditions, operational difficulties, transmitting antenna current, height of transmitting and receiving antenna, etc.

(2) Be certain to fill in sheet numbers in right hand corner to maintain continuity of data sheets.

Tested by: _____

_____

TABLE 4–4. RADIO INTERFERENCE DATA SHEET

Test Location _____ Test Number _____

Specification _____ Date _____

Test Sample:

TYPE		OTHER:
MFR.		
MODEL		
SERIAL		
FREQ RANGE		
CURRENT		
VOLTAGE		
LINE FREQ.		
POWER		

Radio Interference Correction Measures Incorporated in Test Sample.

Test Equipment:

MODEL				
FREQ.				
SERIAL				
CAL.				
PICKUP				
PICKUP				
PICKUP				

Tested by: _____

_____

Note: Make detailed site description, diagrams, and remarks on reverse side

Sheet One of____ Sheets

TABLE 4–5. RADIO INTERFERENCE DATA SHEET

Test Equipment: Model _____ Test Number _____
Serial _____
Pickup _____ Date _____

Test Sample: Type _____ Model _____

BAND	FREQ. IN MC	CORR. FACT.	FI		QP		PEAK		PEAK	REMARKS
			IND.	CORR.	IND.	CORR.	IND.	CORR.		

Tested by: _____
_____

Note: Attenuator settings for indicated readings shown by powers of ten
Additional remarks and notes on reverse side.

Sheet _____ of _____ Sheets

wiring or structural members will affect the field pattern. In some cases, these errors can be determined with the equipment mounted in a designated location. Correction factors so obtained may then be applied to compensate for pick-up pattern distortion.

When a variety of equipment, including radio receivers, is employed at any one site, check for interaction.

Choose at least three sites not in a line for radio interference surveys, since triangulation is used to locate the source of interference.

Note

Survey results must be evaluated according to how close actual survey sites approach ideal conditions.

(2) INTERFERENCE SURVEY.—An interference survey of a suspected area should begin with a series of measurements, at the frequencies under investigation, made with the appropriate pick-up. It is customary in general surveys to make measurements at five frequencies in each band of the equipment, with sufficient overlap to insure complete coverage of all bands. Should a station or service be found operating on the frequency selected for measurement, move sufficiently away in frequency to avoid side bands of the station. The survey report should, however, note the frequency and field intensity of signals from the station.

Certain types of interference surveys require scanning an entire band for evidence of peaks or minima. Any such peaks or minima found must be measured and noted in the survey report.

During the survey, the received signals should be aurally monitored at a volume level that will enable identification of the received signal or interference.

Three-point fixes on each source of interference enable the geographic location to be determined by triangulation, using magnetic bearing. The next step is to investigate each interference source in turn, moving the RI-FI Meter close to each source of interference and refining the distant fix previously obtained. When the location has been narrowed down to a small area, use the loop probe to determine the offending equipment or power line.

If the interference source is found to be a power line or other current-carrying conductors, substitute the line probe for the loop and use the RI-FI Meter as a two-terminal voltmeter to determine the amount of conducted interference on the line.

WARNING

STANDARD SAFETY PRECAUTIONS SHOULD BE TAKEN WHEN CONNECTING TO POWER LINES OF ANY EQUIPMENT WHICH MAY BE ENERGIZED FROM A SWITCH NOT UNDER THE CONTROL OF THE OPERATOR OF RADIO INTERFERENCE MEASURING SET AN/URM-47. ALL CONNECTIONS SHALL BE MADE WITH THE POWER DISCONNECTED FROM THE LINES OR EQUIPMENT.

(3) RATIONALIZING OF INTERFERENCE DATA.—It may be observed that a difference in meter indication may exist between two RI-FI Meters in the same location measuring the same noise signal. It is the purpose of the following paragraphs to explain and provide correction factors for this effect.

Variations in the "Q" of tuned circuits, in tube loading, in individual electron tube characteristics and slight tracking differences are normally present in all equipments of this type. For this reason variations in the overall bandpass of equipments are present.

This problem may be resolved by converting the meter reading into microvolts-per-kilocycle bandwidth as a two-terminal voltmeter and into microvolts-per-meter-per-kilocycle bandwidth as a field intensity meter.

If the bandwidth is other than one kilocycle, then the conversion factor (K), by which the meter reading is to be multiplied, will depend upon the type of signal and the bandwidth, as shown below.

(*a*) In the case of a sine wave signal, the peak, average and effective voltages are *independent* of bandwidth. The factor, applicable to readings taken in function switch positions FIELD INTENSITY, QUASI PEAK, and PEAK, is therefore:

$$K = 1$$

(*b*) For an interference signal of a predominantly random nature, the peak and average voltages are proportional to the square root of the effective "random interference" bandwidth. The signal is assumed to be random in nature if the ratio of the QP/FI readings is approximately 2 or less. The conversion factor, also applicable to readings taken in function switch positions FIELD INTENSITY, QUASI PEAK, and PEAK, is:

$$K = \frac{1 \text{ kc}}{\sqrt{\text{Effective "random interference" bandwidth in kc}}}$$

(Example: Determine the signal strength in microvolts-per-meter-per-kilocycle when the RI-FI equipment, used as a field intensity meter, indicates 1200 microvolts-per-meter. The QP function was used to measure this value. The frequency is 116 megacycles, the interference signal is predominantly random, and the effective "random interference" bandwidth is 116 kilocycles (see figure 4–6 for bandwidth):

$$K = \frac{1 \text{ kc}}{\sqrt{116}} = 0.0928$$

$1200 \times 0.0928 = 111.36$ *microvolts-per-meter-per-kilocycle.)*

(*c*) When the interference signals are predominantly impulsive, the peak value of the voltage is directly proportional to the effective impulsive bandwidth. The signal is assumed to be impulsive in nature if the ratio of the QP/FI readings is greater than 2.

A conversion factor for impulsive measurements is not necessary with this equipment. The procedure for measuring impulsive signals as presented under paragraph 4.*e.*(6) provides readings directly in terms of microvolts-per-kilocycle without involving bandwidth.

Average and quasi-peak readings of impulsive signals are also influenced by pulse repetition rate, pulse width, charge time of weighting circuits and the overload factor. For this reason, a definite conversion factor cannot be supplied.

(*d*) The following chart will enable the operator to determine proper detector functions and multiplication factors to use in making various types of measurements.

INTERFERENCE PLUS SIGNAL CHART

TYPE NOISE (1)	TYPE SIGNAL (2)	DETECTOR FUNCTION	DIRECT	RMS*
Random	Sine Wave	Field-Intensity Quasi-peak	X	X
Random	Random	Field-Intensity Quasi-peak		X X
Random	Impulse High Repetition	Field-Intensity Quasi-peak	X	X

Note: Internal interference is of a random nature.

**RMS = Root Mean Square, e.g.,*

$$\sqrt{[signal\ (1)]^2 + [signal\ (2)]^2}$$

SECTION 5

OPERATOR'S MAINTENANCE

1. INTRODUCTION.

Operator's maintenance procedures are limited to emergency tube change and replacement of line fuses in the RI-FI Meter and power supply units.

2. EMERGENCY MAINTENANCE.

a. TUBE REPLACEMENT. *(See figures 5–1 through 5–4.)*–

Note

Because of the precision nature of this equipment and because of the danger that unnecessary removal and handling subject them to possible breakage, the routine checking and replacement of tubes is *discouraged.* Several ruggedized tubes have been employed, particularly to make use of their long life expectancy. The equipment actually constitutes a tube tester in itself, for it provides self-contained calibration and standardizing means.

Periodic testing of tubes in this equipment should be avoided. In case of equipment failure because of a faulty tube or tubes, be sure to replace each tube in its original socket after checking; this is imperative in order to prevent the need for realignment of the equipment.

In an emergency the RI-FI Meter and power supply units can be opened in the field for testing and replacing defective tubes. The locations and identification of all tubes are shown in figures 5–1 and 5–2. If available, use a miniature tube pin straightener to align the pins of the miniature tube bases (see figure 5–3).

Note

If the video amplifier tube V113 or the control voltage regulator tube V305 must be replaced, be sure to use the same type tube (6AU6WA). If this type is not available, a type 6AU6 can be used for replacement. If the fifth i-f amplifier tube V110 must be replaced, use the same tube type (6005); if not available, however, a type 6AQ5 may be used. Use these alternate tube types only when absolutely necessary. Do *not* use alternate tube types for any of the other tubes in the RI-FI Meter.

To open the RI-FI Meter for tube replacement, place the unit face down on the two front panel guards. Loosen two Dzus fasteners on the back of the instrument case. Lift the case off the chassis. The miniature tubes in this equipment are held in place by spring-loaded tube shields. To remove a tube, depress and turn the tube

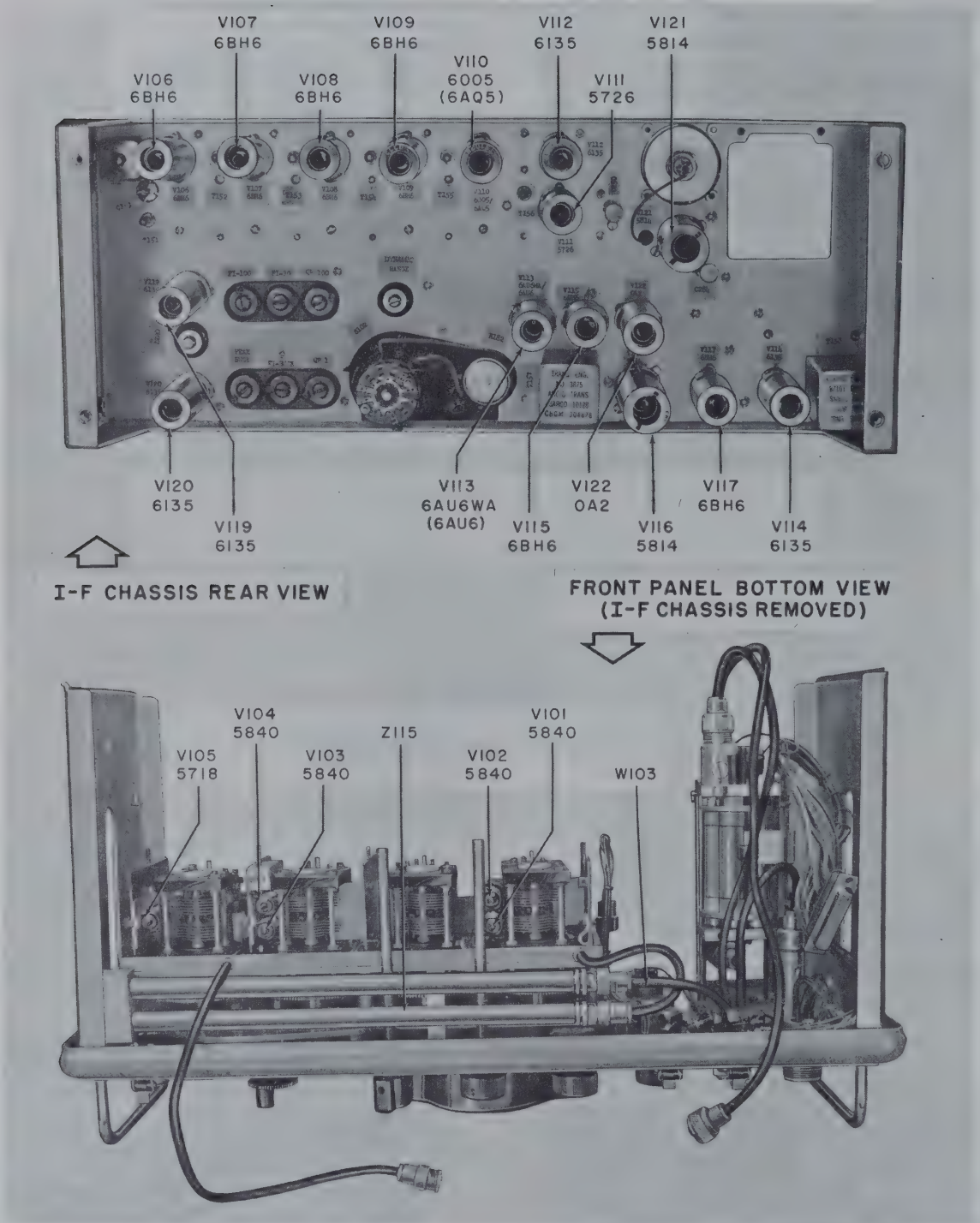


Figure 5–1. Radio Interference-Field Intensity Meter IM-88/URM-47, Tube Locations

shield counterclockwise, then lift. To remove tubes, use rubber tube extractor located on right-hand gusset above the r-f head (see figure 5–5).

CAUTION

Do not remove any tube without first turning off the set. Failure to observe this caution can result in excessive voltage at the filaments (heaters) of some other tubes in the set. The ballast resistor in the power supply may fail if subjected to an overload.

Subminiature tubes are located within the r-f stages and can be removed, if necessary, for replacement. Dis-

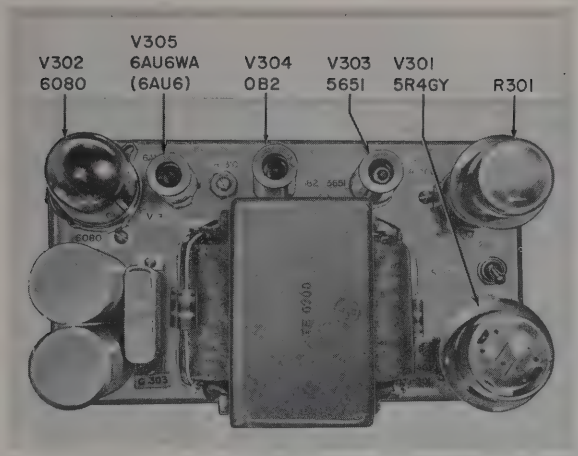


Figure 5–2. Power Supply PP-906/URM-47, Tube Locations

engage the cable strap holding the cable associated with P104. Detach the AUDIO and function switch shaft couplings (see figure 7–3) by means of the Allen wrenches, H135, H136, and H137, which are mounted on top of the r-f head shield cover (see figure 5–5). (Note the position of the function switch for replacement purposes.) Loosen two Dzus fasteners, one on each side of the chassis, and remove two screws located at the rear of the r-f attenuator. Remove the i-f chassis and the r-f head shield cover for access to the subminiature tubes. The subminiature tubes are held in place by cylindrical silver-plated bronze shields (see figure 5–4) which are attached to tube shield plates. The tube shield plate is used to conduct and dissipate the heat emitted from the tube.

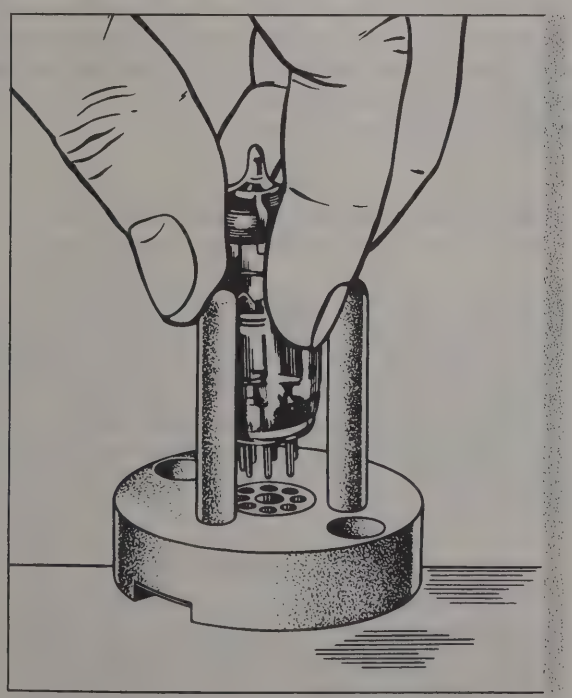


Figure 5–3. Miniature Tube Pin Straightener

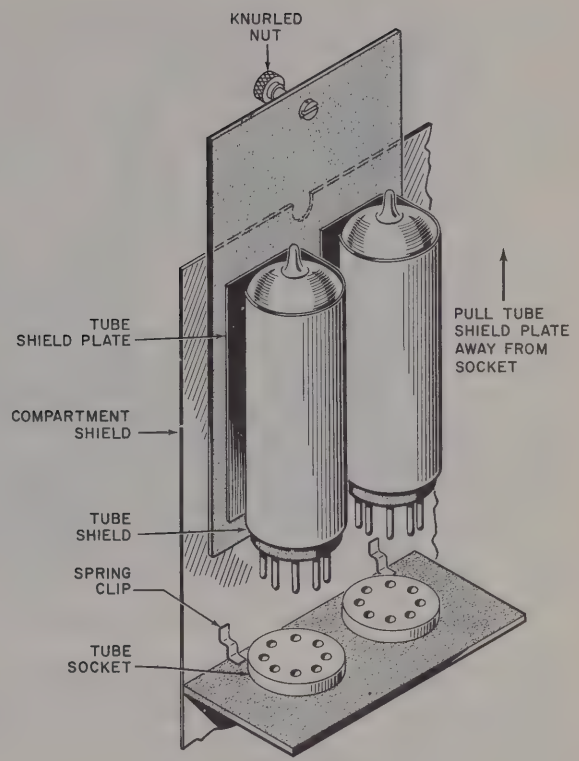


Figure 5–4. Removal of Subminiature Tubes

Each tube shield plate is held to the adjacent compartment shield by means of a captive knurled nut. Loosen the knurled nut. Slide out the shield assembly in a direction away from the tube socket. The tube can now be removed from the shield by gently pushing the tube out, using a pencil eraser against the end opposite the pins. If the tube shield plate does not remove the tubes, the tube extractor may be used. (The tube extractor is normally stored on the right-hand gusset above the r-f head, see figure 5–5.) The new tube is mounted in the socket and then the shield plate with spring shields placed over the tube.

Note

Be sure that the replaced tube shield plate makes contact with two spring clips located adjacent to the socket.

Should any of the following tubes be replaced, the associated control circuits may be affected:

(1) Replacement of V302, V303, or V305 in the power supply unit may affect the B+ voltage supply. After a tube replacement, check the B+ voltage. Allow several minutes for the equipment to warm up. Adjust the B+ voltage to + 225 volts by means of the regulator adjustment control R310 (see figure 7–9).

(2) Tube V106 influences the X10 position of the attenuator and also the tuning of T151 and T152. In the event of replacement, repeat the alignment procedure in paragraph 8.*c.*(2), Section 7.

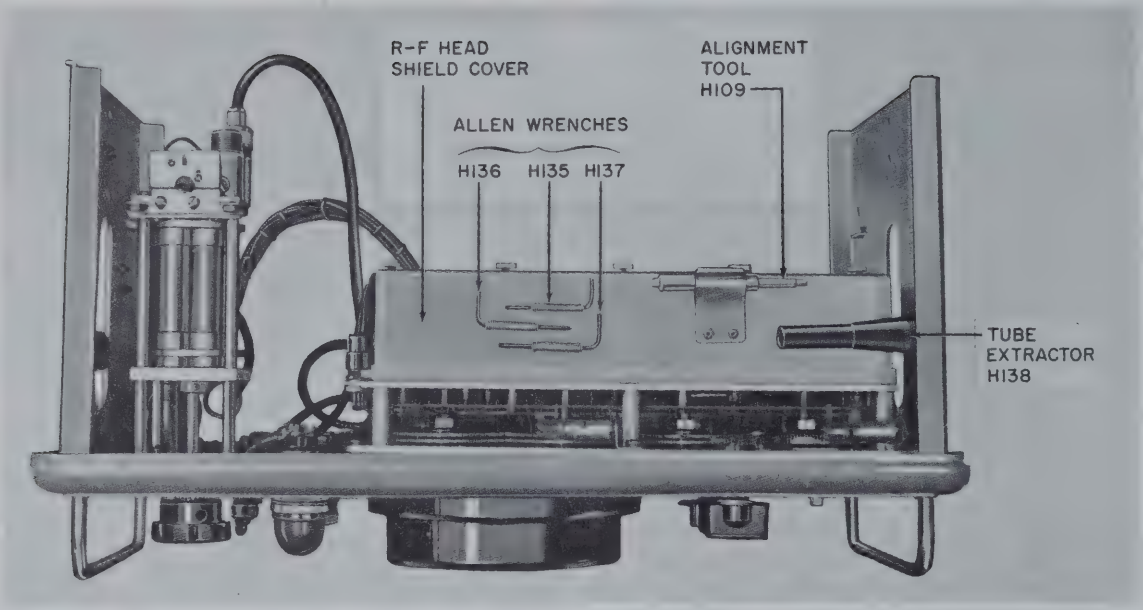


Figure 5–5. Radio Interference-Field Intensity Meter IM-88/URM-47, Location of Accessory Tools

(3) Tubes V107 and V108 influence the output meter scale tracking and also the tuning of T152, T153, and T154. In event of replacement, repeat the alignment procedure of paragraph 8.*c.*(2), Section 7.

(4) Tube V109 controls the gain equalization between the FIELD INTENSITY and QUASI PEAK position of the function switch and also tuning of T154 and T155. If replacement of this tube is necessary, review the alignment procedure of paragraph 8.*c.* (2), Section 7.

(5) Replacement of V110 may affect the dynamic range of the equipment and the tuning of T155 and T156. Repeat the alignment procedure in paragraph 8.*c.* (2), Section 7.

Note

In removing the tube shield of V110, observe the aluminum washer placed between the top of the tube and the tube shield. This washer is required to maintain a fixed capacity between the tube shield and the tube elements. Place the washer on top of V110 before replacing the tube shield. In the event the washer has been lost, obtain a replacement with the following dimensions: 51/64 in. OD by 0.144 in. ID by 1/32 in. thick.

(6) The output meter scale tracking in the lower portion of the scale and the tuning of T156 may be affected by a replacement of tube V111. This can occur in all positions of the function switch, except the BFO position. In event of replacement, repeat alignment procedure of paragraph 8.*c.*(2), Section 7.

(7) Tubes V119 and V120 influence the meter zero adjustment. Tube V119 also can influence the AGC circuit in the event of gas current (new tubes are especially poor in this respect). In event of replacement of V119 or V120 review alignment in paragraph 8.*b,* Section 7.

To open Power Supply PP-906/URM-47, place the unit face down on the two front panel guards and remove the ten screws from around the sides of the instrument case. Lift the case off the chassis.

Any of the tubes in the power supply can be replaced without seriously affecting the calibration of the RI-FI Meter, providing the B+ voltage is maintained at +225 volts by means of regulator adjustment control R310. Tube clamps employed in this unit can be operated with the fingers, or by means of a screwdriver inserted in the slot of the clip.

Note

Be certain to replace all tube shields and to lock all tube clamps before closing the units.

b. FUSE REPLACEMENT.—Either or both of the line fuses may be blown if the indicator lamp on the power supply unit does not light when the POWER switch is placed in the ON position. Spare fuses of the same rating are located in the spare fuse holders on the power supply front panel. Replace fuses in the spare fuse holders (after the spares have replaced the line fuses) as soon as possible.

WARNING

Never replace a fuse with one of a higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it again until the cause has been located and corrected.

SECTION 6

PREVENTIVE MAINTENANCE

1. GENERAL.

Preventive maintenance procedures for the RI-FI Meter and the power supply units should be kept to a minimum for the following reasons:

(1) There is little likelihood of moisture or dirt accumulating inside the units to result in breakdowns because the main units are drip-proof.

(2) Components, including electron tubes, used in the equipment under normal conditions of operation have long life.

(3) No parts in the basic equipment require lubrication. Careful handling while setting up and during operation will prevent most breakdowns from occurring.

a. VOLTAGE CHECK.—Connect Power Supply PP-906/URM-47 to a 115-volt, 60-cycle external power source. Measure the voltages appearing at the RI-FI Meter receptacle J106 under load conditions. Correct voltages at J106 are: 6.3 volts ac between pin A and chassis, +225 volts dc between pin B and chassis, and —105 volts dc between pin C and chassis. (See figure 7–14.)

b. SENSITIVITY AND CALIBRATION CHECKS.—These checks are embodied in the operating procedure. The operator must standardize the gain of the equipment according to the instructions given in Section 4, paragraph 4.*e.* The operator can detect any radical change in the sensitivity of the unit because this condition will necessitate a CALIBRATE control setting at a point greatly different from that normally used to obtain standard gain. Low sensitivity is usually accompanied by abnormally high internal noise level indicated on output meter.

c. IMPULSE CALIBRATOR GENERATOR CHECK.—Check the operation of the impulse calibrator at periodic intervals of approximately 100 operating hours for variations in amplitude of the output pulses. Refer to paragraphs 4.*b.*(3).(*a*) and 4.*b.*(3).(*b*) in Section 7 of this instruction book for complete checking procedures.

SECTION 7

CORRECTIVE MAINTENANCE

1. INTRODUCTION.

The procedures, illustrations, and tables in this section are for the purpose of assisting maintenance personnel in the repair and adjustment of Radio Interference Measuring Set AN/URM-47. When the equipment has failed in operation the source of the trouble must be located, the defect remedied, and the equipment restored to operating condition. The information is, therefore, presented in the following order:

Localization of Trouble (paragraph 2)

Removal of Chassis from Instrument Cases (paragraph 3)

Radio Interference-Field Intensity Meter IM-88/URM-47 Trouble Shooting and Repair (paragraph 4)

Power Supply PP-906/URM-47 Trouble Shooting and Repair (paragraph 5)

Maintenance Procedures (paragraphs 6 through 9)

Illustrations contained in this section include an overall schematic diagram, practical wiring diagrams, voltage and resistance data, and internal views of the equipment with component parts identified by reference symbol number.

Table 7–1 lists all the accessory test equipment necessary for proper maintenance of the equipment.

The tables included at the end of this section are:

Table 7–3. Electron Tube Operating Voltages

Table 7–4. Winding Data

Note

Maintenance personnel must fill out a failure report for each part, component, tube, or mechanical assembly repaired or replaced.

TABLE 7–1. ACCESSORY TEST EQUIPMENT

Signal Generator AN/URM-26 series, TS-497/URR, or equivalent high-impedance input instrument.
6-db, 50-ohm pad for output termination of signal generator.
Electronic Multimeter AN/USM-34, ME-25/U, Multimeter AN/PSM-4, or equivalent 20,000-ohm-per-volt multimeter.
Frequency Meter AN/USM-29 series, Frequency Meter LM series, or equivalent.

2. LOCALIZATION OF TROUBLE.

a. INTRODUCTION.—Trouble shooting problems in Radio Interference Measuring Set AN/URM-47 may be located just as troubles are located in communication receivers. Inspect the entire equipment in an attempt to isolate the faulty unit. Check the interconnecting cabling between units. Determine that the required power is applied to Power Supply PP-906/URM-47 and that the operating potential outputs of the power supply are applied to the RI-FI Meter. The power supply indicator lamp I301 and the RI-FI Meter dial light I101 serve to indicate power application to the respective units. Determine whether or not an output indication can be obtained on the remote meter. Check that panel operating controls are properly employed as described in Section 4.

If one of the r-f input devices is the source of the trouble, check the continuity of the circuit through the suspected device.

When apparent lack of operating potential output from the power supply is noted, check by making voltage measurements at the output connector.

Note

The power supply may become warm during normal operation but this is not to be considered as an indication of a defect.

In the event malfunctioning of the equipment is caused by the RI-FI Meter, continue the elimination procedure with the aim of locating the faulty stage. The RI-FI Meter is similar to a communications receiver, having an r-f section, i-f section, and a-f section. In addition, it has a calibrator circuit, VTVM circuit, attenuation circuits, detector weighting circuits, and a pulse amplifier and visual null indicator circuit. Consult the trouble shooting chart, figure 7–2, for aid in locating a faulty stage or circuit.

FAILURE REPORTS

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD 787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment nameplate), the type number of the major unit (from the major unit nameplate), and the type number and reference designation of the particular defective part (from the instruction book). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember – there are two sides to the failure report –

"YOUR SIDE"

Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office."

Figure 7–1. Failure Report

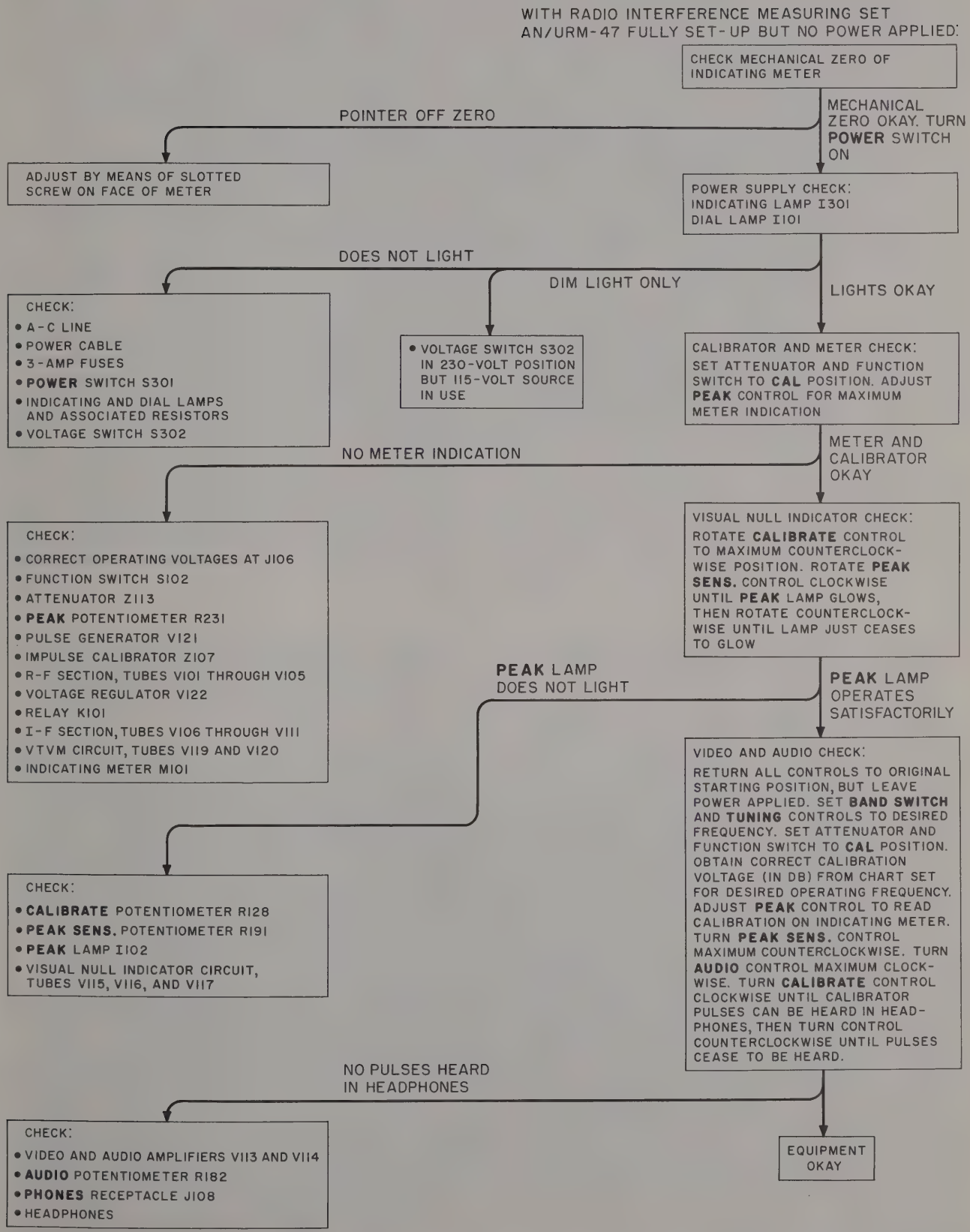

WITH RADIO INTERFERENCE MEASURING SET AN/URM-47 FULLY SET-UP BUT NO POWER APPLIED:
CHECK MECHANICAL ZERO OF INDICATING METER
POINTER OFF ZERO
ADJUST BY MEANS OF SLOTTED SCREW ON FACE OF METER
MECHANICAL ZERO OKAY. TURN POWER SWITCH ON
POWER SUPPLY CHECK: INDICATING LAMP I301 DIAL LAMP I101
DOES NOT LIGHT
CHECK:
• A-C LINE
• POWER CABLE
• 3-AMP FUSES
• POWER SWITCH S301
• INDICATING AND DIAL LAMPS AND ASSOCIATED RESISTORS
• VOLTAGE SWITCH S302
DIM LIGHT ONLY
• VOLTAGE SWITCH S302 IN 230-VOLT POSITION BUT 115-VOLT SOURCE IN USE
LIGHTS OKAY
CALIBRATOR AND METER CHECK: SET ATTENUATOR AND FUNCTION SWITCH TO CAL POSITION. ADJUST PEAK CONTROL FOR MAXIMUM METER INDICATION
NO METER INDICATION
CHECK:
• CORRECT OPERATING VOLTAGES AT J106
• FUNCTION SWITCH S102
• ATTENUATOR Z113
• PEAK POTENTIOMETER R231
• PULSE GENERATOR V121
• IMPULSE CALIBRATOR Z107
• R-F SECTION, TUBES V101 THROUGH V105
• VOLTAGE REGULATOR V122
• RELAY K101
• I-F SECTION, TUBES V106 THROUGH V111
• VTVM CIRCUIT, TUBES V119 AND V120
• INDICATING METER M101
METER AND CALIBRATOR OKAY
VISUAL NULL INDICATOR CHECK: ROTATE CALIBRATE CONTROL TO MAXIMUM COUNTERCLOCKWISE POSITION. ROTATE PEAK SENS. CONTROL CLOCKWISE UNTIL PEAK LAMP GLOWS, THEN ROTATE COUNTERCLOCKWISE UNTIL LAMP JUST CEASES TO GLOW
PEAK LAMP DOES NOT LIGHT
CHECK:
• CALIBRATE POTENTIOMETER R128
• PEAK SENS. POTENTIOMETER R191
• PEAK LAMP I102
• VISUAL NULL INDICATOR CIRCUIT, TUBES V115, V116, AND V117
PEAK LAMP OPERATES SATISFACTORILY
VIDEO AND AUDIO CHECK: RETURN ALL CONTROLS TO ORIGINAL STARTING POSITION, BUT LEAVE POWER APPLIED. SET BAND SWITCH AND TUNING CONTROLS TO DESIRED FREQUENCY. SET ATTENUATOR AND FUNCTION SWITCH TO CAL POSITION. OBTAIN CORRECT CALIBRATION VOLTAGE (IN DB) FROM CHART SET FOR DESIRED OPERATING FREQUENCY. ADJUST PEAK CONTROL TO READ CALIBRATION ON INDICATING METER. TURN PEAK SENS. CONTROL MAXIMUM COUNTERCLOCKWISE. TURN AUDIO CONTROL MAXIMUM CLOCKWISE. TURN CALIBRATE CONTROL CLOCKWISE UNTIL CALIBRATOR PULSES CAN BE HEARD IN HEADPHONES, THEN TURN CONTROL COUNTERCLOCKWISE UNTIL PULSES CEASE TO BE HEARD.
NO PULSES HEARD IN HEADPHONES
CHECK:
• VIDEO AND AUDIO AMPLIFIERS V113 AND V114
• AUDIO POTENTIOMETER R182
• PHONES RECEPTACLE J108
• HEADPHONES
EQUIPMENT OKAY

Figure 7—2. Radio Interference-Field Intensity Meter IM-88/URM-47, Trouble Shooting Chart

One major source of improper equipment operation is incorrect calibration and alignment control adjustment. Operational tests are given in this section to aid in determining the efficiency of equipment operation. Complete calibration and alignment procedures are also given to aid in bringing the equipment up to its highest sensitivity and accurate calibration. (See paragraphs 6 through 9.)

b. OPERATIONAL TESTS. *(See figure 7–2.)*—When localizing procedures definitely point to a trouble in the RI-FI Meter, the source can readily be traced to any given stage. The calibrating circuit of V121 constitutes a convenient signal generator for checking the receiver operation. Turn the function switch S102 and the PULL-TURN-PUSH attenuator control to the CAL position. This results in the application of plate voltage to the calibrator circuit and consequent injection of an impulse noise signal at the receiver input. If the r-f, i-f, and detector circuits are functioning, an audible pulse signal will be heard in the headphones with PEAK control (C) counterclockwise and CALIBRATE control (D) clockwise. To check the visual null indicator circuit, proceed as follows: Rotate PEAK control (C) to its maximum clockwise position. Rotate PEAK SENS. control (E) clockwise until PEAK indicator lamp I102 lights. Rotate PEAK SENS. control (E) counterclockwise until indicator lamp just ceases to light. Check the audio and video sections by setting function switch (B) to the FIELD INTENSITY position, tune receiver to a known frequency, then adjust AUDIO control (F) for comfortable audio volume level in headphones.

3. REMOVAL OF CHASSIS FROM INSTRUMENT CASE.

Upon determining that the trouble source is in either the RI-FI Meter or power supply, the next step is to remove the suspected chassis from its case and trace the trouble to a faulty component.

To open the RI-FI Meter, stand the unit on its front panel guards. Loosen two Dzus fasteners on the back of the instrument case. Slide the case off the chassis.

To open the power supply, stand the unit on its front panel guards. Remove ten screws at the sides and slide the case off the chassis.

The i-f chassis section of the RI-FI Meter may be removed from the main chassis section. Disengage the cable strap holding the cable associated with P104. Detach the AUDIO and function switch shaft couplings (see figure 7–3) by means of the Allen wrenches H135, H136, and H137 which are mounted on top of the r-f head shield cover (see figure 5–5). (Note the position of the function switch for reassembly purposes.) Loosen two Dzus fasteners, one on each end of the chassis, and remove two screws located at the rear of the r-f attenuator. The i-f chassis can now be removed for inspection, trouble shooting, etc.

The units can be reassembled by following the given procedures in a reverse sequence.

4. RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 TROUBLE SHOOTING AND REPAIR.

a. TROUBLE SHOOTING DATA.—
Schematic Diagram—Figure 7–14
Practical Wiring Diagram—Figure 7–12
Voltage and Resistance Data—Figure 7–11
Component Locations—Figures 7–3 through 7–8
Winding Data—Table 7–4

b. REPAIR AND ADJUSTMENT DATA.

(1) ACCESS TO COMPONENTS. *(See figures 7–3 through 7–8.)*—In accordance with shielding requirements at the high frequencies employed in this equipment, the r-f and i-f stages are enclosed within separate individual shielded compartments. The covers of the r-f and i-f stage compartments can be readily removed by unscrewing the fastening screws and nuts. Allen wrenches are supplied with the equipment (see figure 5–5) for aid in removal of components.

(2) TUBE CHANGE.—The tubes employed for this equipment have been especially selected for specific characteristics. In order to avoid any possible upset of alignment and calibration, avoid interchanging tubes and replace tubes only when absolutely necessary. Tube locations are shown in figure 5–1. Subminiature tubes are employed within the r-f compartments. Refer to Section 5, paragraph 2 for the removal of subminiature tubes.

Note

Do not remove more than one tube at a time to avoid damaging the ballast resistor R301. A more detailed explanation of tube removal is given in Section 5.

(3) CHECKING AND MAINTAINING IMPULSE CALIBRATOR.—The impulse calibrator (Z107) should be checked for uniformity of output pulse amplitude at periodic intervals of approximately 100 operating hours. Variations in amplitude of the output pulses indicate defective or dirty contact points. The method for detecting such variations and the maintenance procedures required to insure normal operation of the impulse calibrator are given below.

(*a*) CHECKING CONTACT CONDITION.

Step 1. Set up the equipment for normal operation, apply power and allow a suitable warm-up period before proceeding.

Step 2. Calibrate the equipment for standard gain choosing an operating frequency near the low-frequency limit of the equipment.

Step 3. Using the PEAK control as an adjustment, determine the threshold point where the pulses just become inaudible (or lamp of visual null circuit just ceases flashing) in the headphones. Note the meter scale indication in decibels.

Step 4. Slowly rotate the PEAK control counterclockwise until all of the pulses are audible in the

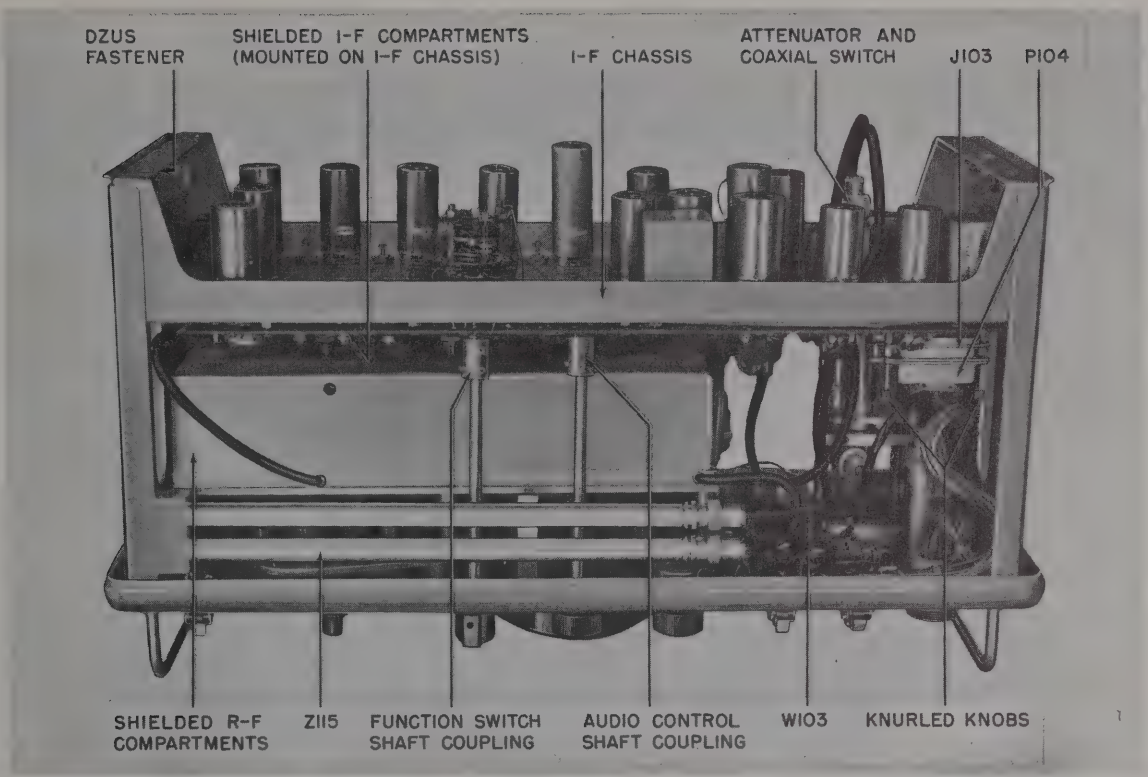


Figure 7–3. Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Bottom View (Case Removed)

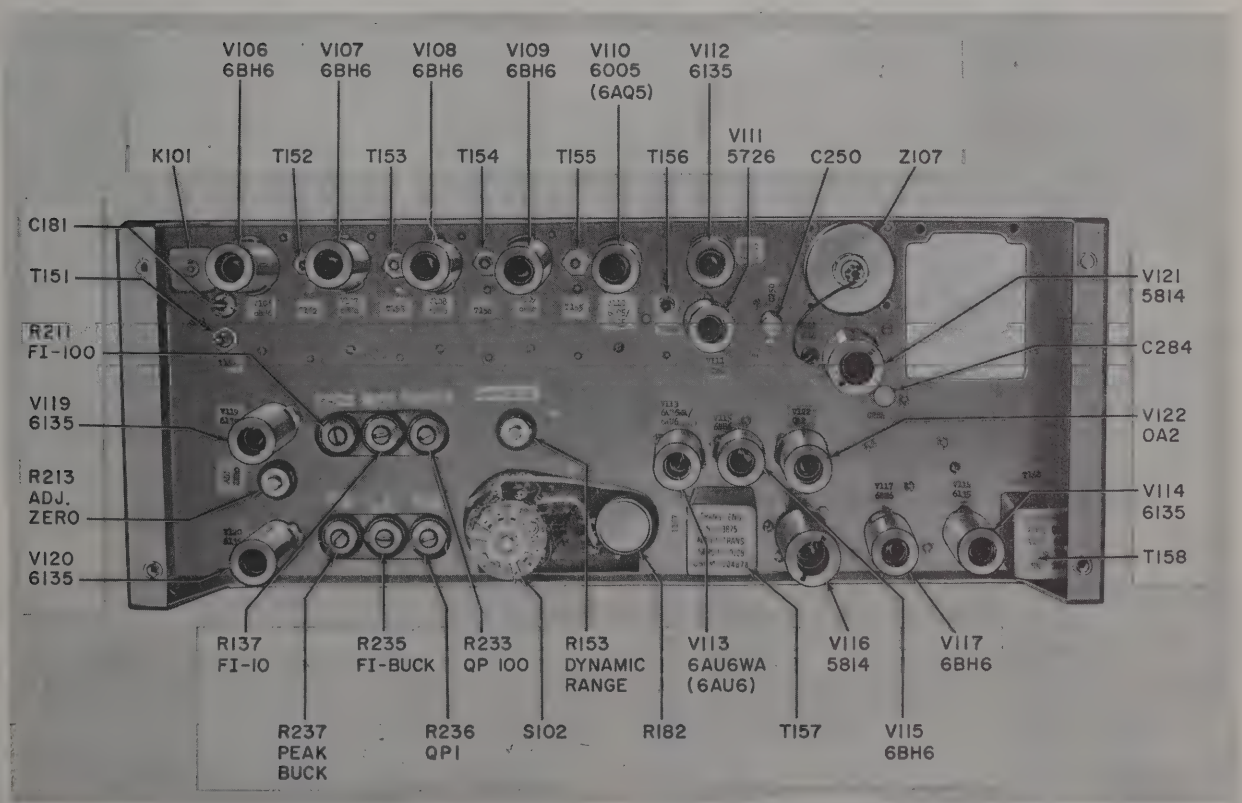


Figure 7–4. Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Rear View (I-f Chassis)

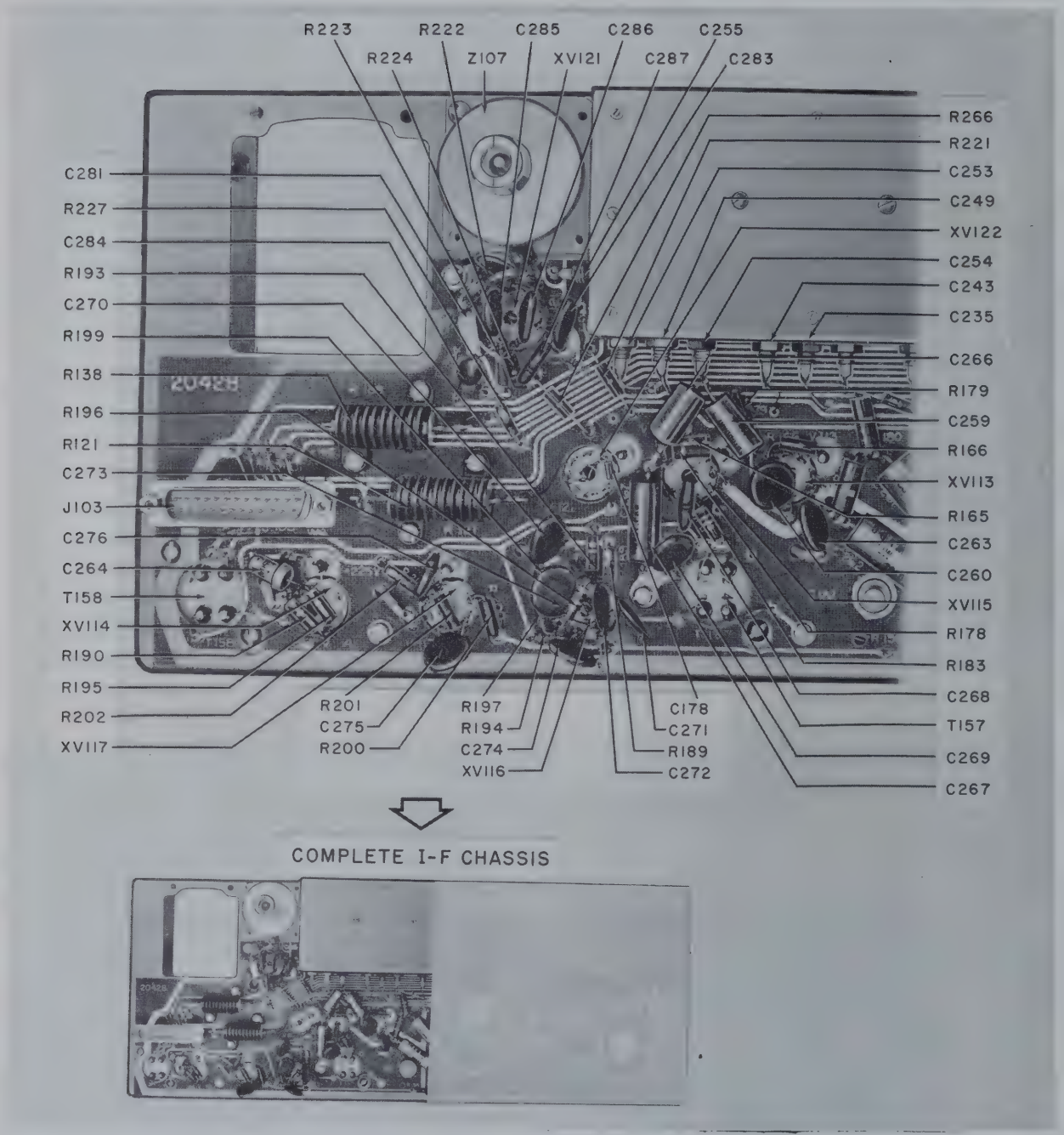


Figure 7—5. Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Sheet 1 of 2 Sheets)

headphones (or lamp just flashes in unison with mechanical sound of contactor), but do not exceed this point. Note the meter scale reading in decibels for this condition.

Step 5. Subtract the reading obtained in Step 4 above from the reading noted in Step 3 above. The difference should be less than about two decibels if the impulse calibrator is functioning properly. If the difference is more than about two decibels, dirty contacts are indicated and maintenance is required as outlined in subparagraph (*c*) below.

(*b*) CHECKING CONTACT GAP SPACING.

Step 1. Leave the calibration setting of the equipment fixed at the point determined in subparagraph (*a*) above. Reverse the polarity of the charging potential applied to the impulse calibrator by rotating the function switch to FI position and then returning it to the CAL position.

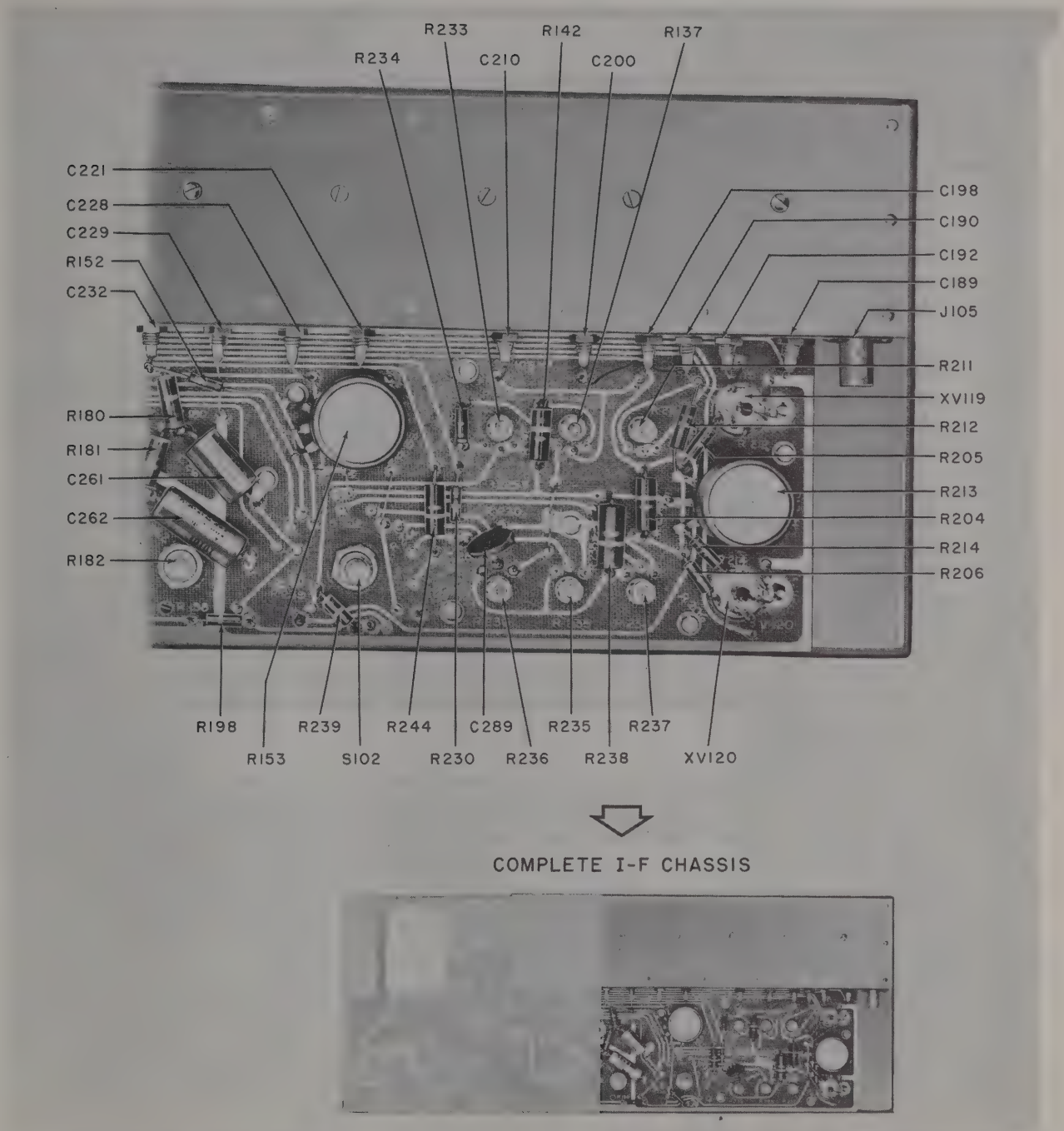


Figure 7—5. Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Sheet 2 of 2 Sheets)

Step 2. Repeat the adjustment given by Step 3 in subparagraph (*a*) above and note the meter scale reading in decibels for the reversed charging polarity.

Step 3. Compare the meter reading obtained in Step 3 of subparagraph (*a*) above with that obtained in Step 2 above. If the difference in readings is less than about 0.8 db, the spacing between contacts is satisfactory. If the two readings differ by more than 0.8 db, the gap between contacts may be excessive. The following step should be performed before attempting to adjust contact spacing.

Step 4. Measure the charging potential applied to the feed-through capacitor on one end of the impulse generator for both positive and negative polarity. An electrostatic voltmeter, or d-c vacuum tube voltmeter having an input impedance of at least 100 megohms should be used for this test to prevent excessive current drain through the series supply resistances. The charg-

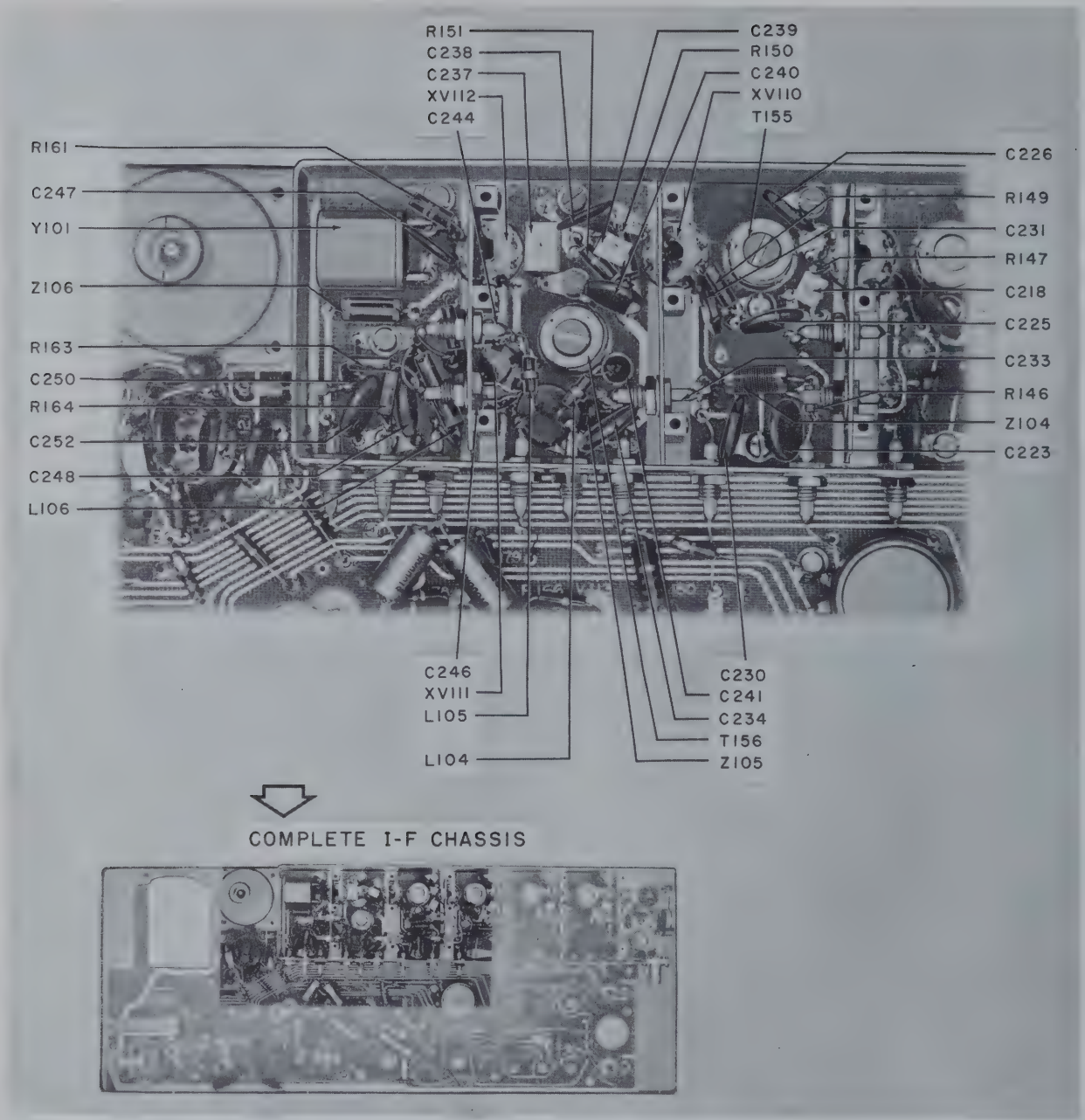


Figure 7–6. Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Showing Compartments) (Sheet 1 of 2 Sheets)

ing potentials measured should normally be equal within plus or minus six per cent. If the values are considerably different, the voltage supply sources should be investigated. If the charging potentials are within the correct limits, and the difference in meter readings for standard gain settings with opposite charging potentials is still more than about 0.8 db, the contact gap spacing should be adjusted as outlined in subparagraph (*d*) below.

(*c*) CLEANING CONTACTS.—If the test outlined in subparagraph (*a*) above has been made and dirty contacts are indicated, the following steps should be taken:

Step 1. Remove the main chassis from the instrument case and detach the i-f section chassis as outlined in paragraph 3 of this section. Lay the i-f section alongside the main chassis with the front panel side of the i-f chassis facing up. Disconnect P106 from the impulse calibrator (Z107) output receptacle (see figure 7–4).

Step 2. Using the No. 6 Allen wrench (H135) supplied with the equipment, loosen the two set screws holding the pulse output receptacle.

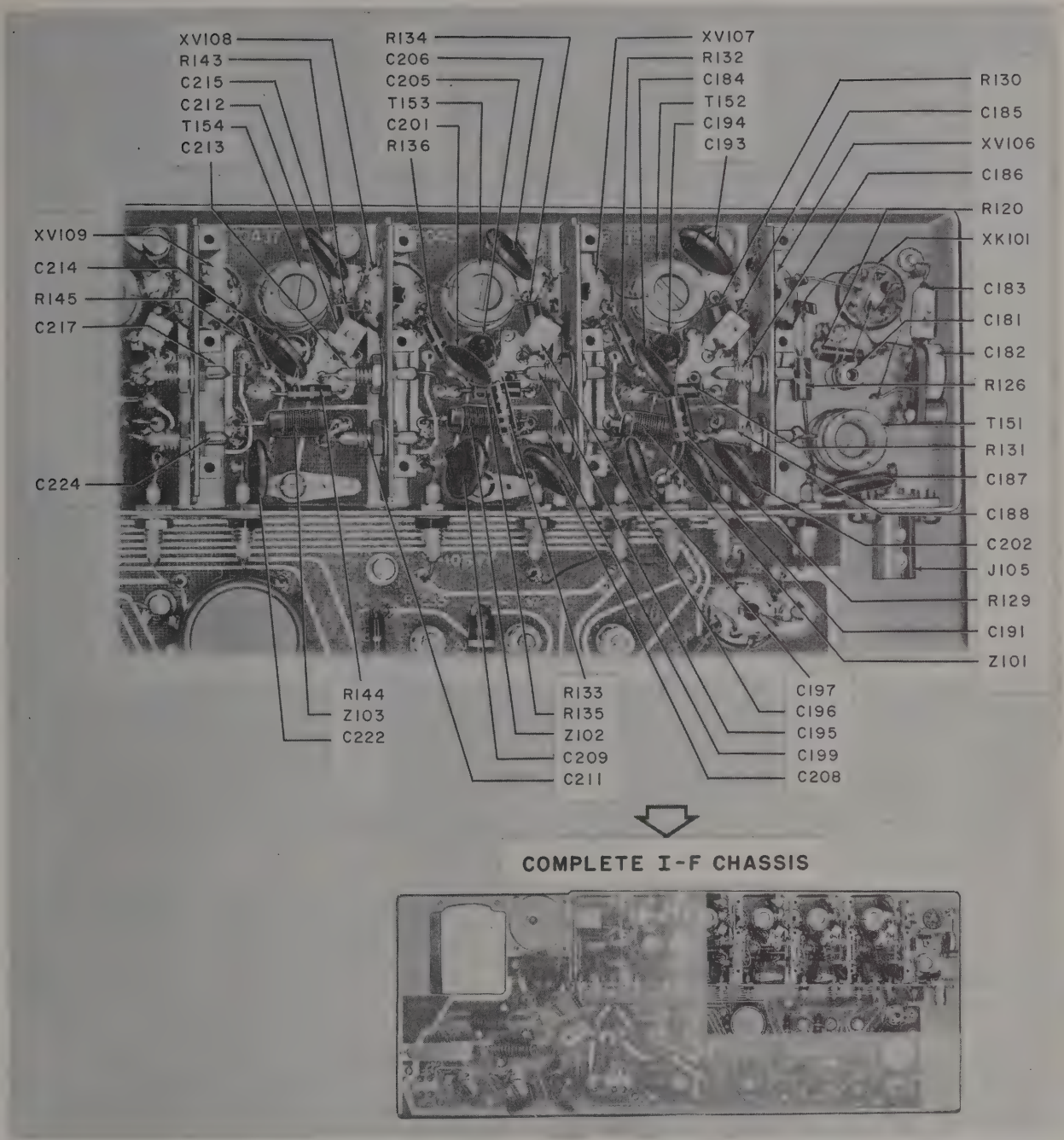


Figure 7—6. Radio Interference-Field Intensity Meter IM-88/URM-47, I-f Chassis Front View (Showing Compartments) (Sheet 2 of 2 Sheets)

Step 3. Loosen the receptacle body, using a piece of 1/16-inch sheet metal or a twenty-five cent coin piece as a screwdriver placed in the slots in the end of the receptacle. Place the i-f chassis facing up so that the movable contactor will not drop out when the connector body is removed. Unscrew the connector by hand. The connector body, connector pin, a series resistor, a shunt disc resistor, the discharge contact and housing should emerge as a unit. If only the connector body comes away, remove the remaining pieces as a unit.

Step 4. Place a piece of clean white bond paper on a flat surface; hold the connector body vertical and burnish the contact on the inner end of the connector by using a circular motion to slide the contact lightly over the paper. Burnish until all blackened deposit on the contact is removed. Do *not* use sand paper, crocus, or emery cloth.

Step 5. Replace the connector body in the generator assembly; tighten with the improvised screwdriver, tighten the set screws, and connect the r-f cable

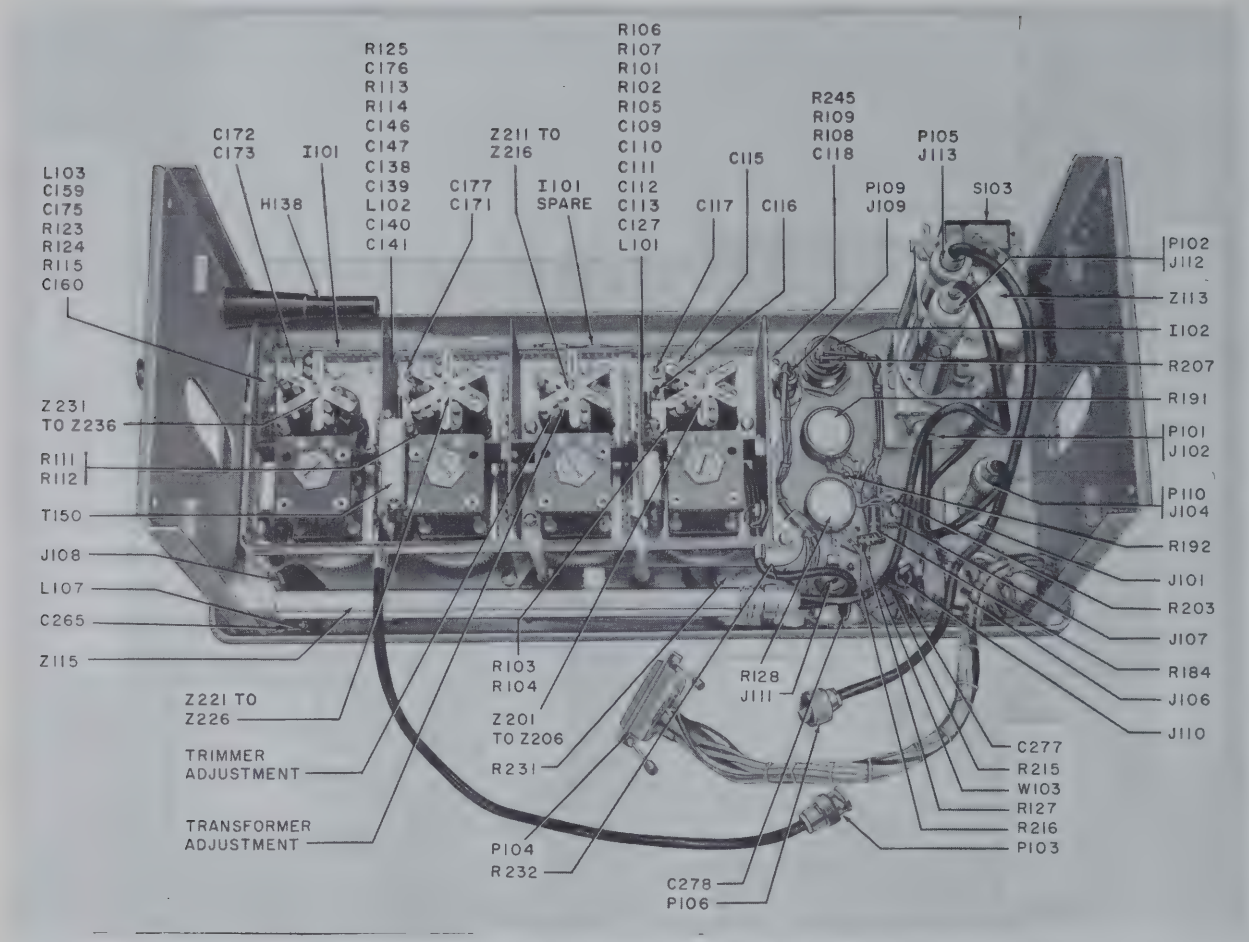


Figure 7–7. Radio Interference-Field Intensity Meter IM-88/URM-47, Chassis Rear View (I-f Chassis Removed)

to the pulse output receptacle of the impulse calibrator.

Step 6. Apply power to the equipment and check operation of the impulse calibrator. If still unsatisfactory, remove power from the equipment and proceed as below.

Step 7. Unsolder the lead connected to the feed-through capacitor mounted on the input tube. This is on the end of the impulse calibrator assembly opposite the pulse output receptacle.

Step 8. Unscrew the feed-through capacitor and draw it straight out of the input tube. The series charging resistor and charging contact will come out with the capacitor as one assembly.

Step 9. Hold the charging contact as near the contact end as possible and burnish as outlined in Step 4 above. Be very careful not to bend or otherwise damage the contact and resistor assembly.

Step 10. Replace the assembly in the input tube and tighten the feed-through capacitor in place. Resolder the lead to the feed-through capacitor, being careful not to damage the ceramic sleeve on the capacitor.

Step 11. Apply power to the equipment and check operation of the impulse calibrator. If still unsatisfactory, proceed as outlined below.

Step 12. Remove power from the equipment and remove the output receptacle as outlined in Steps 1 through 3 above.

Step 13. Place a hand in front of the receptacle opening and turn the equipment over, shaking gently until the center movable contactor falls out of the impulse calibrator into the hand.

CAUTION

Exercise extreme care in handling the contactor because the very small diameter discharge contact may be broken or considerably damaged if mishandled.

Step 14. Hold the contactor in a vertical position with a light finger grip and burnish the *larger* of the two axially located contacts (charging contact) as outlined in Step 4 above.

Step 15. Clean the sides of the smaller discharge contact by scraping with the edge of a strip of clean

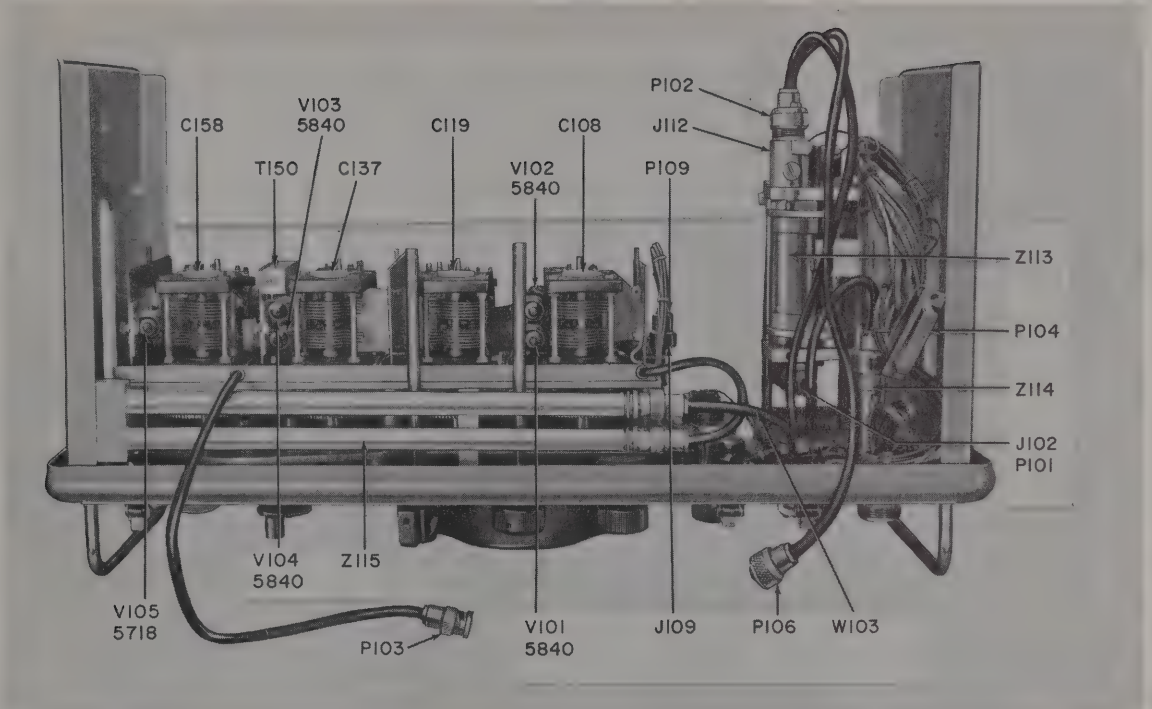


Figure 7—8. Radio Interference-Field Intensiity Meter IM-88/URM-47, Chassis Bottom View (I-f Chassis Removed)

white bond paper. *Do not* burnish the small diameter contact point by the procedure given in Step 4 because the point may catch on a paper surface and bend or break very easily. The small contact surface may be cleaned by carefully stroking with the edge of a piece of paper and should be inspected after cleaning with an eye-glass or microscope to make sure that no lint or other foreign particles are on the contact. Inspect the small contact with an eye-glass for a mushroomed end shape. This appearance would be the result of excessive pounding caused by too great a contact gap, in excess of 0.005 inch. If the small contact is deformed in this manner, it can be honed back to its original shape with a small, flat, fine file. Repeated inspection with an eye-glass is recommended during this operation. When completed, any metal burrs must be removed from the small contact edge and surface.

Step 16. Inspect the body of the contactor. Remove any foreign particles or surface irregularities that might impede its travel within the insulating sleeve.

Step 17. Using a pair of tweezers, return the contactor to its position in the impulse calibrator. *The large contact must enter the opening first.*

CAUTION

The contactor has a close tolerance fit within the insulating sleeve and must not be forced. If the contactor does not enter the sleeve because of incorrect alignment, touching the high outer edge will be sufficient to start entry.

Step 18. Replace the receptacle and secure as outlined in Step 5 above. Operation of the impulse calibrator should now be satisfactory, provided that the spacing (or gap) between contacts has not been changed.

(*d*) ADJUSTING CONTACT SPACING.—If the tests made in accordance with subparagraph (*b*) above indicate that the gap between contacts is excessive, the adjustments outlined below should be made, after being certain that all of the contacts are free of foreign material as outlined in subparagraph (*c*) above.

Step 1. After noting the meter scale readings for opposite charging voltage polarities as outlined in subparagraph (*b*) above, remove power from the equipment and remove the feed-through capacitor with its resistor contact assembly as outlined in Steps 7 and 8 of subparagraph (*c*) above.

Step 2. Hold the hexagonal flange of the feed-through capacitor in a vise so that the contact resistor and small sleeve used to connect the resistor lead to the feed-through capacitor extend in a horizontal direction beyond the sides of the vise. Use care in this and the following operation to prevent damage to the ceramic feed-through capacitor and to prevent misalignment of the assembly.

Step 3. Loosen the soldered joint between the resistor lead and the small sleeve that connects the resistor to the feed-through capacitor, and increase the length of the assembly very slightly by approximately three to five thousandths of an inch. This is best accomplished by heating the joint with a small soldering iron and simultaneously twisting the resistor slightly under very small axial tension with a finger grip. When the first indication of movement in the joint is observed,

release the tension and twisting action so that the joint is held in position until the solder has hardened.

Step 4. Inspect the assembly for foreign material and for misalignment, cleaning and straightening it if necessary.

Step 5. Insert the assembly into the input tube of the impulse calibrator but do not engage the threads on the input tube and feed-through capacitor bushing by more than one turn.

Step 6. Apply power to the equipment, energize the impulse calibrator driving circuit and carefully observe the audible noise made by operation of the generator.

Step 7. Rotate the feed-through capacitor bushing very slowly so that engagement of the threads is increased, at the same time listening to the "beats" of the generator. As the assembly is slowly screwed into the input tube, the sound of the beats will change when the spacing has been decreased so that alternate contact is made between the movable contactor and the fixed charge and discharge points. The beats will sound uniform when the movable contactor is stopped in each direction by the fixed points, and the sound will diminish as the spacing is decreased, although still maintaining uniform beats.

CAUTION

If the assembly has been increased in length too much by the operation of Step 3 above, the gap spacing will be reduced to zero before the feed-through capacitor is tightened in the input tube. This clamps the movable contactor between the stationary contacts and may cause damage to the small discharge contact, especially if the feed-through capacitor is tightened beyond the point where zero gap spacing occurs. A definite change in mechanical sound will be apparent as this condition is approached. Clamping the movable contactor by reducing the gap spacing to zero is to be avoided and the feed-through capacitor should be removed at once. Decrease the length of the assembly by using a technique similar to that outlined in Step 3 above, except for applying a very slight axial pressure to the resistor instead of tension.

Step 8. If the feed-through capacitor bushing can be tightened in the input tube without stopping the impulse calibrator as cautioned in Step 7 above, remove power from the equipment and re-solder the charging voltage lead to the feed-through capacitor terminal.

Step 9. Apply power and check the meter scale readings for both polarities of charging voltage as outlined in subparagraphs (*b*) and (*a*) above.

Step 10. The difference between the two meter readings will be decreased from the difference noted at the beginning of these tests if the effective gap between contacts has been decreased. A difference of less than about 0.3 db may be obtained by proper adjustment of contact spacing, assuming that all other checks outlined above have been made, and that the opposite polarity charging voltages are very nearly equal.

Step 11. If the difference in meter readings is more than about 0.3 db for opposite charging polarities, the above procedure should be repeated until proper contact spacing is obtained.

(4) REPLACEMENT OF PARTS.—Defective parts should be replaced with correct replacement parts as listed in Section 8. Upon removing the defective part, install the replacement part in the exact position of the original part. Keep the leads on the replacement part the exact length as those on the original part.

When coaxial connectors have been disconnected during maintenance procedures, securely tighten the connectors before placing the RI-FI Meter in service. This is extremely important in order to avoid discontinuity at the coaxial connector which adversely affects the standing wave ratio on the coaxial line.

(5) REPAINTING.—The paint on the instrument case and accessories may require touch-up work. Paint specifications used on the equipment are as follows:

(*a*) Equipment cases and protective covers—Specification MIL-E-15090A, Type III, Class II.

(*b*) Antenna element identification color bands-two coats of Dupont Dulux, 93 Line enamel (or equivalent) in the following color order were applied over one coat of Dupont Preparakate No. 65-1055 gray primer (or equivalent):

23-1/2 in. element	No. 93-2622R	Red
16-1/4 in. element	No. 93-5248	Yellow
23-1/2 in. tapered element	No. 93-1650	Green
Long telescopic element	No. 93-3430	Blue
Short telescopic element	No. 93-21667	White

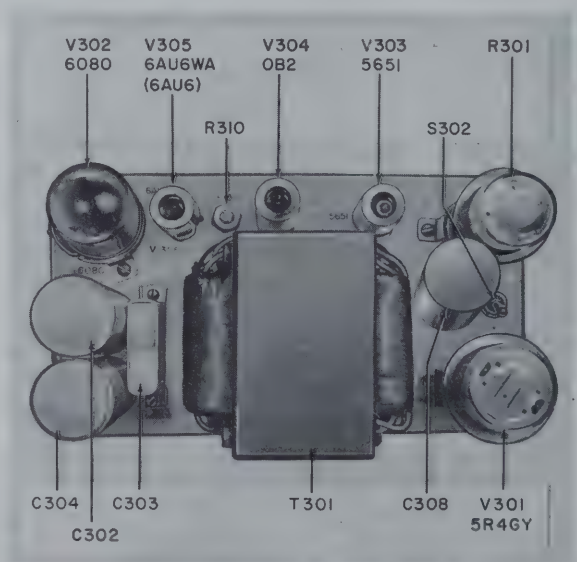


Figure 7–9. Power Supply PP-906/URM-47, Chassis Top View

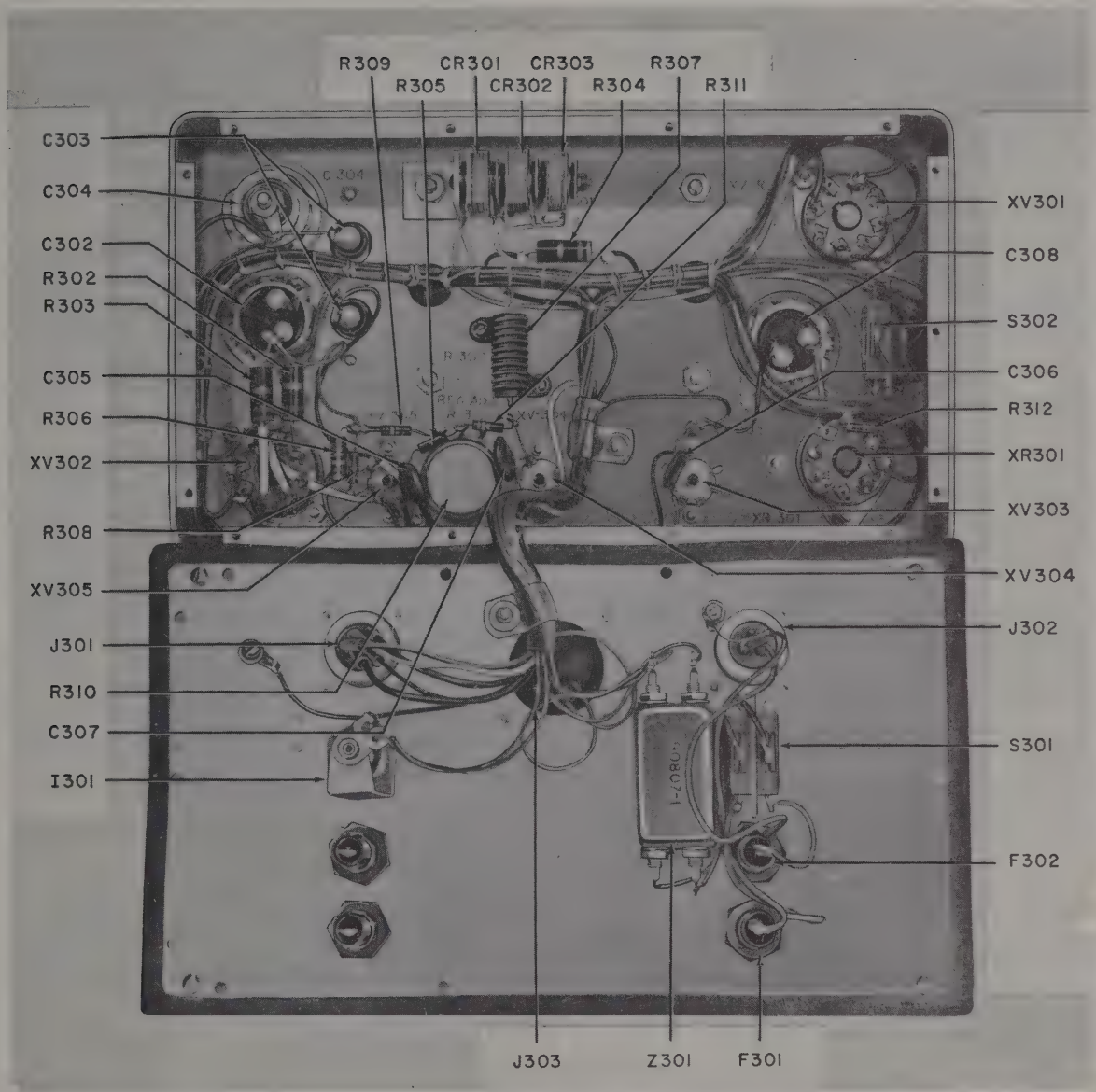


Figure 7–10. Power Supply PP-906/URM-47, Chassis Bottom View

5. POWER SUPPLY PP-906/URM-47 TROUBLE SHOOTING AND REPAIR.

a. TROUBLE SHOOTING DATA.–
Schematic Diagram–Figure 7–14
Practical Wiring Diagram–Figure 7–13
Voltage and Resistance Data–Figure 7–11
Component Locations–Figures 7–9 and 7–10
Winding Data–Table 7–4

b. REPAIR AND ADJUSTMENT DATA.

(1) TUBE CHANGE.–Any of the tubes in the power supply can be replaced without affecting the calibration of the RI-FI Meter. It would be wise, however, to check the output voltage of the power supply under load after tubes have been replaced. Tube locations are shown in figure 5–2.

Tube clamps employed in this unit can be operated with the fingers, or by means of a screwdriver inserted in the slot of the clip.

(2) VOLTAGE ADJUSTMENT.–The required value of B+ output voltage is determined by the setting of the regulator adjustment control R310, which sets the grid bias for the control tube V305. The input power line voltage should be adjusted to 115 volts. Connect the RI-FI Meter to the power supply to provide the proper load conditions. Remove the power supply chassis from the case. Remove the RI-FI Meter from its case. Connect a 20,000-ohm-per-volt multimeter, such as model AN/PSM-4 series or equivalent, between J106, pin B, and chassis. Adjust R310 for a reading on the voltmeter of +225 volts.

Note

If an open filament circuit has occurred or if any of the tubes of the RI-FI Meter have been withdrawn for replacement, the current limiting resistor R301 may have been damaged and its resistance altered. Check that the output voltage at i-f chassis receptacle J106, pin A, to chassis is 6.3 volts ac. Also check the bias supply (—105 volts dc) at this time using a 20,000-ohm-per-volt multimeter connected between J106, pin C, and chassis.

6. EQUIPMENT REQUIRED FOR ALIGNMENT AND ADJUSTMENT.

a. RADIO INTERFERENCE MEASURING SET AN/URM-47 UNITS.—

Radio Interference-Field Intensity, Meter IM-88/URM-47.

Power Supply PP-906/URM-47

A-c power cable Assembly CADV-62480 (6′ 0″)

Power Cable Assembly CADV-62481 (10′ 0″)

R-f transmission line Cable Assembly CG-92D/U (20′ 0″)

Coaxial cable patch cord comprising RG-58/U or RG-58A/U cable with connector types UG-29/U and UG-201/U

Headphones Navy Type —49753 or equivalent

Alignment Tool H109 (located in RI-FI Meter, see figure 5—5)

b. TEST AND MISCELLANEOUS EQUIPMENT. *(See table 7—1.)*—

Signal Generator AN/URM-26 series, TS-497/URR, or equivalent high-impedance input

Electronic Multimeter AN/USM-34, or equivalent

6-db, 50-ohm pad for output termination of signal generator

7. SET-UP OF EQUIPMENT FOR ALIGNMENT AND ADJUSTMENT PROCEDURES.

Note

Before commencing alignment and adjustment of this equipment, check the mechanical zero setting of the front panel meter. It is possible that correcting this zero setting will correct the symptoms of misalignment or maladjustment and the equipment can be returned to service.

Step 1. Remove the RI-FI Meter from its case (Section 5, paragraph 2) and set up on a bench or table.

Step 2. Interconnect the RI-FI Meter and the power supply by means of power Cable Assembly CADV-62481 (10′ 0″). Turn the POWER switch S301 to the OFF position.

Step 3. Connect the power supply to a source of 115 volts ac, preferably 60 cps, by means of the a-c power cable Assembly CADV-62480 (6′ 0″). Ground the clip at the input end of this cable.

Note

Check that switch S302 located on the power chassis is set for 115 volts and that the metal reminder tag on the front panel is likewise set.

8. ALIGNMENT AND ADJUSTMENT PROCEDURES.

a. PRELIMINARY CHECKS PRIOR TO ACTUAL ALIGNMENT.—Turn the power supply POWER switch S301 to the ON position.

Note

Allow a one-hour warm-up period before commencing alignment and adjustment procedures. The locations of screwdriver controls referred to in the following procedures are shown in figures 7—4 through 7—8. Various mechanical adjustments referred to herein are located on figures 7—4 and 7—7.

Check the following voltages at the points indicated:

(1) B+ (+225 volts): Check at the POWER receptacle J106, pin B, located on the RI-FI Meter.

(2) Bias supply (—105 volts): Check at the POWER receptacle J106, pin C.

(3) Filament supply (6.3 volts ac): Check at the POWER receptacle J106, pin A.

b. PRELIMINARY METER TRACKING ADJUSTMENT.

(1) ADJUSTMENT OF ELECTRICAL ZERO.

Step 1. Set function switch S102 to the BFO position.

Step 2. Set the Adj. Zero control R213 for a zero meter reading.

Note

All screwdriver controls contain a locking nut which must be loosened to allow adjustment of the control. The locking nut must be tightened after adjustment.

(2) CHECK FOR GAS CURRENT.

Step 1. Set up the following operating controls:

Attenuator (A)	CAL
Function Switch (B)	FIELD INTENSITY
Tuning dial frequency (H)	Any

Step 2. Turn the FI-10 control R137 and the FI-Buck control R235 to maximum counterclockwise positions. The meter indication should not go below zero. If it does, gas current is present in V119. Replace V119 with a tube that does not contain gas current.

Step 3. Adjust the meter zero as in subparagraph *b.*(1), preceding.

(3) PRELIMINARY ADJUSTMENT OF FI-10 CONTROL.

Step 1. Set up the following operating controls:

Attenuator (A)	CAL
Function switch (B)	FIELD INTENSITY
Dial frequency (H)	Any

Step 2. Using the 20,000-ohm-per-volt multimeter such as AN/PSM-4 or equivalent (see table 7—1), connect the negative lead to the chassis (ground) and the positive lead to the arm of the FI-10 control R137. (See figure 7—14.) Adjust the FI-10 for a meter indication of approximately 4 volts dc.

(4) PRELIMINARY ADJUSTMENT OF DIODE BUCKING VOLTAGE.

Step 1. Set up the following operating controls:

Attenuator (A)	CAL
Function switch (B)	FIELD INTENSITY
Dial frequency (H)	Any
CALIBRATE (D)	Fully counterclockwise

Step 2. Adjust the FI-Buck control R235 to provide approximately 1 per cent (1/16-inch) deflection of panel indicating meter M101.

c. INTERMEDIATE FREQUENCY ALIGNMENT.

(1) SET-UP OF EQUIPMENT FOR I-F ALIGNMENT.

Step 1. Remove i-f amplifier chassis from gusset plates (two Dzus fasteners, AUDIO and function switch shaft couplings and r-f attenuator screws).

Step 2. Disconnect P103 from J105.

Step 3. Connect output of signal generator to i-f amplifier input connector J105 using r-f transmission line Cable Assembly CG-92D/U (20′ 0″), coaxial cable patch cord and connectors type UG-29/U and UG-201/U.

Step 4. Plug headphones into PHONES receptacle J108.

Step 5. Energize equipment.

(2) ALIGNMENT OF I-F TRANSFORMERS.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	As called for
CALIBRATE (D)	Fully clockwise
AUDIO (F)	Fully clockwise

Step 2. Adjust signal generator frequency to BFO frequency, modulation off. This can be done by setting function switch to BFO position and tuning signal generator in vicinity of 15 megacycles for a beat note as heard in headphones.

Step 3. Turn function switch to FIELD INTENSITY position. Adjust signal generator output and CALIBRATE control (D) for an up-scale reading on output meter M101.

Step 4. Using 3/16-inch nut wrench, adjust i-f transformers T151 through T156 for maximum indication on M101, readjusting CALIBRATE control as needed to maintain an "on scale" reading.

d. FINAL METER TRACKING ADJUSTMENTS.

(1) SET-UP OF EQUIPMENT FOR METER TRACKING ADJUSTMENTS.—Use set-up described in i-f alignment, paragraph 8.*c.*(1), preceding.

(2) ADJUSTMENT OF THE FI-10, FI-100 AND FI-BUCK CONTROLS.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	FIELD INTENSITY
CALIBRATE (D)	As called for

Step 2. With signal generator still at BFO frequency and with internal modulation off, adjust output to 50-microvolt level. Adjust CALIBRATE control so that M101 indicates 1 microvolt.

Step 3. Increase output of signal generator to 5000 microvolts. Adjust FI-100 control R211 so that M101 reads full scale, 100 microvolts.

Step 4. Decrease signal generator output to 50 microvolts and readjust CALIBRATE control (D) for 1-microvolt reading.

Step 5. Repeat Steps 2 through 4 until both points fall into place without further adjustment.

Step 6. Set signal generator output to 500 microvolts. M101 should indicate 10 microvolts. If not, adjust FI-10 control R137 for M101 indication of 10 microvolts. If error is one or more microvolts, move meter reading beyond 10 microvolts a few divisions. For example, if meter M101 indicates 13 microvolts instead of the correct value of 10, adjust the FI-10 control R137 for a meter reading of approximately 8 microvolts and vice versa. Then repeat Steps 1 through 6 until meter tracks at 1, 10, and 100 without further adjustment.

Note

Check adjustment of electrical zero occasionally, function switch at BFO position. Check adjustment of diode bucking voltage (see paragraph 8.*b.*(4)); this should be done occasionally.

Step 7. Repeat Steps 1 through 6 and note until meter tracks.

Step 8. Tighten lock nuts on R137, R235, and R211.

(3) ADJUSTMENT OF QP1 and QP 100 CONTROLS.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	As called for
CALIBRATE (D)	As called for

Step 2. With function switch in FIELD INTENSITY position, adjust signal generator output (unmodulated) to 5000 microvolts. Adjust CALIBRATE control (D) for M101 indication of 100 microvolts. Change function switch (B) to QUASI PEAK position. Adjust QP 100 control R233 for output meter indication of 100 microvolts.

Step 3. With function switch (B) in FIELD INTENSITY position, adjust signal generator output (unmodulated) to 50 microvolts. Adjust CALIBRATE control (D) for M101 indication of 1 microvolt. Change function switch (B) to QUASI PEAK position. Adjust QP1 control R236 for output meter indication of 1 microvolt.

Step 4. Repeat Steps 2 and 3 until the indications on the FIELD INTENSITY and QUASI PEAK functions agree without further adjustment. Then compare readings at mid-scale deflection; there should be little difference.

Step 5. Tighten lock nuts on R233 and R236.

(4) ADJUSTMENT OF PEAK BUCK CONTROL.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	As called for
PEAK (C)	As called for
CALIBRATE (D)	As called for
PEAK SENS. (E)	Fully counterclockwise
AUDIO (F)	Fully clockwise

Step 2. Set function switch (B) to QUASI PEAK position. Adjust signal generator output to 50 microvolts with 30 per cent modulation (1000 cycles) and adjust CALIBRATE control (D) for M101 indication of 1 microvolt.

Step 3. Set function switch (B) to PEAK. Adjust PEAK control (C) for M101 indication of 1 microvolt. Adjust Peak Buck control R237 to position where the 1000-cycle audible signal just disappears.

Step 4. Set function switch (B) to QUASI PEAK position. Adjust signal generator output to 5000 microvolts with 30 per cent modulation (1000 cycles) and adjust CALIBRATE control (D) for M101 indication of 80 microvolts.

Step 5. Set function switch (B) to PEAK position. Adjust PEAK control (C) to position where the 1000-cycle audible signal just disappears. Note M101 indication; it should be 80 microvolts. If other than 80 microvolts, repeat Steps 1 through 5 for greater accuracy. If too great an error still exists, replace fixed resistor R239 with larger resistance to lower reading or a lower value to increase reading. (An alternate correction is to replace V109 with a tube of more suitable gain characteristics, but this would require rechecking and possible realignment starting with paragraph 8.*c*.)

Step 6. Tighten lock nut on R237.

(5) ADJUSTMENT OF DYNAMIC RANGE (OVERLOAD CAPACITY) CONTROL.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	FIELD INTENSITY
PEAK (C)	As called for
CALIBRATE (D)	As called for

Step 2. With power turned OFF, temporarily disconnect the wire that connects C200 and passes through eyelet on printed circuit board. Temporarily add a jumper from C200 to the junction of C289 and R230.

Step 3. Connect a high-impedance vacuum tube voltmeter between chassis (positive) and C200 (negative). Turn power ON and allow equipment to warm up. Adjust PEAK control (C) for 100 microvolts deflection of output meter M101. Note voltage reading on VTVM.

Note

If the voltage on the VTVM exceeds 5 volts, difficulty may be experienced in adjusting for 20 db dynamic range in Steps 5 and 6, following. This voltage level is established when adjusting FI-100 control R211 during meter scale tracking procedure. By allowing the "10 microvolt" point to fall a little low when meter scale tracking (see paragraph 8.*d*), the above voltage will be decreased.

Step 4. Connect VTVM between chassis (positive) and junction of C254 and C266 (negative).

Step 5. Adjust signal generator output to 1000 microvolts. Adjust CALIBRATE control for same indication on VTVM as noted in Step 3.

Step 6. Increase signal generator output by 20 db (10 times or to 10,000 microvolts). The VTVM reading should be 9 times original reading (10 per cent down from linearity). (For example, if at start 1000 microvolts input provided 4 volts output, then, with 10,000 microvolts input, there should be $9 \times 4 = 36$ volts output.) If VTVM reading is other than 9 times, adjust Dynamic Range control R153 clockwise if the reading is low, and counterclockwise if reading is high. Repeat Steps 5 and 6 until no further adjustment is required.

Step 7. Remove temporary jumper from C200 to junction of C289 and R230 and resolder wire to C200.

Step 8. Tighten lock nut on R153.

Note

The final adjustment procedures of T150, T151, and attenuator step position X10 are given in paragraph 8.*f*. These final adjustments are performed after the r-f alignment procedures.

e. R-F ALIGNMENT.

(1) SET-UP OF EQUIPMENT FOR R-F ALIGNMENT.

Step 1. Set up the equipment as described in paragraph 7 of this section.

Step 2. Plug headphones into PHONES receptacle J108 on the RI-FI Meter front panel.

Step 3. Insert the coaxial cable patch cord and the 6-db, 50-ohm pad in series with Cable Assembly CG-92D/U (20′ 0″) (between the signal generator and the RI-FI Meter).

Step 4. Connect the signal generator to an external source of 110 volts, 60 cps. Turn the signal generator power switch to its on position.

Note

Frequency calibration of the signal generator should be checked with a suitable frequency meter such as frequency meter LM series or frequency meter AN/USM-29 series. The accuracy of frequency calibration should be within ± 2 per cent.

Step 5. Turn the power supply POWER switch S301 to its ON position and allow a reasonable time for both the signal generator and the RI-FI Meter to reach stable operating temperature before beginning these alignment procedures.

(2) POSITION OF OPERATING CONTROLS.–

Attenuator (A)	X1
Tuning dial (H) frequency	As called for
BAND SWITCH (G)	As called for
Function switch (B)	FIELD INTENSITY
CALIBRATE (D)	As called for
AUDIO (F)	Comfortable headphone level

Note

The function switch (B) on the RI-FI Meter should be in any position except CAL, preferably in the FIELD INTENSITY position, since there is no point in allowing the internal calibrator to operate during the warm-up period.

(3) ALIGNMENT OF R-F CIRCUITS.–

CAUTION

The position of the BAND SWITCH (G) should not be changed after making trimmer slug alignments without being certain that the adjustment screws do not extend beyond the inner surface of the shield cover. Damage to the coil or turret assemblies may result if precaution is not observed.

(*a*) HIGH FREQUENCY END, BAND 1.

Step 1. Set BAND SWITCH (G) on Band 1, set TUNING dial (H) on 33 megacycles, and set the CALIBRATE control (D) for a reading of approximately 1 on the microvolts scale of the output indicator meter M101.

Step 2. Adjust the signal generator for an unmodulated 33-megacycle signal output so that a usable scale reading (approximately half or three-quarters full scale) is obtained on meter M101.

Step 3. Adjust the oscillator trimmer capacitor C161 (part of Z231, see figure 7–7) for maximum deflection of the output meter. (It may be necessary to readjust the signal generator output level to keep the output meter reading less than full scale.)

CAUTION

Do not turn trimmer slugs more than one complete turn in either direction without being certain that the adjustment is being made in the right direction and the screw will clear the shield cover when the coil turret is rotated.

Step 4. Adjust the mixer trimmer capacitor C131 (part of Z221, see figure 7–7) for maximum output on meter M101.

Step 5. Adjust the r-f amplifier plate circuit trimmer capacitor C121 (part of Z211, see figure 7–7) for maximum deflection of the output meter.

Step 6. Adjust the antenna circuit trimmer capacitor C101 (part of Z201, see figure 7–7) for maximum meter deflection.

TABLE 7–2. R-F ALIGNMENT CHART (BANDS 1 THROUGH 6)

CAUTION

Do not turn the tuning slugs more than one complete turn in either direction without being certain that the adjustment is being made in the right direction and that the screw will clear the shield cover when the turret is rotated.

BAND NO.	HIGH END POINTS					LOW END POINTS				
	SIGNAL FREQUENCY (mc)	TRIMMER ADJUSTMENTS				SIGNAL FREQUENCY (mc)	SLUG ADJUSTMENTS			
		OSC.	MIXER	R-F PLATE	ANT.		OSC.	MIXER	R-F PLATE	ANT.
1	33.0	C161	C131	C121	C101	20.0	T131	T121	T111	T101
2	54.0	C162	C132	C122	C102	33.0	T132	T122	T112	T102
3	88.0	C163	C133	C123	C103	54.0	T133	T123	T113	T103
4	145.0	C164	C134	C124	C104	88.0	T134	T124	T114	T104
5	240.0	C165	C135	C125	C105	145.0	T135	T125	T115	T105
6	400.0	C166	C136	C126	C106	240.0	T136	T126	T116	T106

Notes: 1. The oscillator frequency is 15 megacycles above the signal frequency in all bands.

2. Trimmer and slug adjustments are made through small access holes in rear of the r-f shield cover with the BAND SWITCH set on the given position.

3. Trimmer capacitor adjustment screws are located in bottom position (nearest variable tuning capacitor) and inductance slug adjustment screws are in top position (nearest to turret shaft) of the r-f shield cover with the RI-FI Meter in normal position. (See figure 7–7.)

Step 7. Recheck the adjustment of trimmer capacitors C161, C131, C121, and C101 to be certain that all circuits are peaked for maximum output.

(*b*) LOW FREQUENCY END, BAND 1.

Step 1. Set the TUNING dial for a frequency of 20 megacycles (low end of Band 1) and readjust the CALIBRATE control for a reading of approximately 1 microvolt on the output meter M101.

Step 2. Adjust the signal generator for an unmodulated 20-megacycle signal at an output level sufficient to provide a usable deflection on the output meter.

Step 3. Adjust the tuning slug in the oscillator transformer T131 (part of Z231, see figure 7–7) for a maximum output reading on the meter.

CAUTION

Do not turn the tuning slugs more than one complete turn in either direction without being certain that the adjustment is being made in the right direction and that the screw will clear the shield cover when the turret is rotated.

Step 4. Adjust the tuning slugs in the transformers in the mixer grid circuit T121 (part of Z221), the r-f amplifier plate circuit T111 (part of Z211) and the antenna circuit T101 (part of Z201, see figure 7–7), in the order given for maximum output indication.

Step 5. Recheck the adjustments of the transformer slugs of T131, T121, T111, and T101 to be certain that maximum output is obtained.

(*c*) Repeat subparagraphs 8.*e*.(3).(*a*) and 8.*e*. (3). (*b*), immediately preceding, until no further adjustments are necessary.

(*d*) BANDS 2 TO 6.—Bands 2 through 6 are aligned in the same manner as given previously for Band 1, with the proper settings of the high and low end frequencies. Refer to table 7–2 for the adjustment frequencies and circuit adjustments for all bands.

Note

The following notes apply to the alignment of Band 6 only. The range of adjustments of the trimmer capacitor C166 and the inductance slug on the oscillator transformer T136 may be sufficient to place the oscillator frequency 15 megacycles below the signal frequency under certain conditions of adjustment. For example, the oscillator could be 15 megacycles above the signal frequency at the low end of Band 6 and 15 megacycles below the signal frequency at the high end of Band 6. This would cause mistracking over the band, with resultant poor sensitivity. If there is reason to believe that the oscillator is 15 megacycles below the signal frequency, the oscillator frequency should be checked with an instrument having a suitable frequency range such as a grid-dip meter or frequency meter. An alternate method of checking the oscillator frequency is to check the frequency of the i-f image response, which should be 30 megacycles above the signal frequency in all cases. Alignment of the mixer grid circuit on the high end of Band 6 (C136) may cause a slight shift in the oscillator frequency ("pulling") in some cases. The oscillator trimmer C166 should be reset, if necessary, after adjusting the mixer grid trimmer C136 and before adjusting the r-f amplifier plate circuit trimmer C126.

f. FINAL ADJUSTMENT OF T150, T151, AND ATTENUATOR STEP X10.—

Note

This subparagraph presupposes that the r-f alignment has been completed.

Step 1. Set up the following operating controls:

Attenuator (A)	As called for
Function switch (B)	FIELD INTENSITY
CALIBRATE (D)	As called for
Tuning dial frequency (H)	As called for

Step 2. Set up the equipment as indicated in paragraph 7. Connect the signal generator to J101 using the r-f transmission line Cable Assembly CG-92D/U (20′ 0″).

Step 3. Tune signal generator to 20 megacycles and adjust the output to 100 microvolts. Set the attenuator (A) to its X1 position. Tune the r-f head for maximum response to the 20-megacycle signal and adjust the CALIBRATE control (D) for an "up-scale" indication on output meter M101.

Step 4. Tune transformer 150 (see figure 7–8) with the alignment tool (see figure 5–5) and transformer T151 (see figure 7–4) with a 3/16-inch nut wrench for maximum indication on M101; readjust the CALIBRATE control (D) as needed to maintain an "on scale" reading.

Step 5. Set the attenuator (A) to its X10 position. Tune C181 (figure 7–4) for maximum response on M101. Repeat Steps 3 to 5 until no further adjustment is necessary.

Step 6. Change the attenuator (A) setting back to the X1 position. Adjust the CALIBRATE control (D) for an output meter indication of 100 microvolts. Then increase the signal generator output by 10 times (20 db) or to 1000 microvolts. Switch attenuator (A) to its X10 position. Output meter indication should again be 100 microvolts. If attenuator step X10 does not provide 20 db of attenuation, change setting of C182 (figure 7–6) (increase capacitance for less attenuation and decrease capacitance for more attenuation) and repeat Steps 3 through 6. Repeat as often as required to achieve 20 db of attenuation between the X1 and X10 attenuator steps.

9. CORRECTING CHART SET PT-188/URM-47 AFTER ALIGNMENT.

a. GENERAL.—Data plotted on all charts of Chart Set PT-188/URM-47 have been plotted for the individual equipment as shipped. Upon completing the maintenance procedures described in paragraph 8, it is necessary to obtain new data and plot these charts accordingly. The original plot can be erased and new curves drawn in with pencil or draftsman's pen. If the overall bandpass of the equipment is the same as before and an accurate signal generator is used, it is possible that the original data will be closely repeated and redrawing of the charts thus becomes unnecessary.

After the RI-FI Meter has been aligned in accordance with the instruction in paragraph 8, obtain data for Chart Set PT-188/URM-47 at each of the following calibrating frequencies:

BAND	*FREQUENCIES (mc)*
1	20, 23, 26, 29, 33
2	33, 37, 42, 48, 54
3	54, 62, 70, 80, 88
4	88, 100, 115, 130, 145
5	145, 170, 195, 220, 240
6	240, 280, 320, 360, 400

b. CALIBRATING PROCEDURE.

(1) CHART NO. 6 AND NO. 7 (EFFECTIVE "RANDOM INTERFERENCE" BANDWIDTH).—The overall bandwidth of the RI-FI Meter is influenced by the selectivity of the r-f tuned circuits; therefore, bandwidth data must be taken at radio frequencies listed immediately preceding.

Step 1. Set up the following operating controls:

Attenuator (A)	X1
Function switch (B)	FIELD INTENSITY
CALIBRATE (D)	As called for

Step 2. Connect output of Signal Generator AN/URM-26 to J101 using r-f transmission line Cable Assembly CG-92D/U (20′ 0″).

Step 3. Adjust signal generator frequency to 20 megacycles. Adjust output to 1000 microvolts.

Step 4. Tune RI-FI Meter for maximum response to test signal. Adjust CALIBRATE control (D) for M101 indication of 60 microvolts.

Step 5. Increase signal generator output by exactly 3.7 db (1.53 times).

Step 6. Decrease the signal generator frequency to about 18 megacycles, then slowly increase the frequency beyond 20 megacycles. Observe the two signal generator frequencies at which M101 indicates 60 microvolts. Record the difference in frequency between the two observed points; this is the overall effective "Random Interference" bandwidth at this test frequency.

Note

In order to counteract backlash in the signal generator tuning mechanism, always sweep the signal generator frequency continuously in one direction from a point below the calibrating frequency upward to a point above the calibrating frequency. The two frequencies will be quite close together so use the vernier markings on the signal generator tuning knob for accurate readings.

Step 7. Repeat Steps 3 through 6 for each of the test frequencies.

Step 8. Using the vertical scale of Chart No. 6 and No. 7, plot the points of 3.7-db bandwidth determined in Step 6. Draw a smooth curve through the plotted points.

(2) CHART NO. 1 AND NO. 2 CALIBRATION SETTINGS.

Step 1. Set up the following operating controls:

Attenuator (A)	As called for
Function switch (B)	As called for
PEAK (C)	As called for
PEAK SENS. (E)	As called for
Tuning dial frequency (H)	As called for

Step 2. Using Cable CG-92D/U (20′ 0″), connect the RI-FI Meter to output of Signal Generator TS-497/URR.

Note

The absolute value of calibration depends on the accuracy of the calibrating source.

Step 3. Adjust signal generator frequency to 20 megacycles. Adjust output to 100 microvolts.

Step 4. Set RI-FI Meter attenuator (A) to X1 position, function switch (B) to FIELD INTENSITY position. Tune RI-FI Meter for maximum response to test signal. Adjust CALIBRATE control (D) for M101 indication of 100 microvolts.

Step 5. Turn attenuator (A) to CAL position. Set function switch (B) to CAL position. Turn PEAK control (C) maximum clockwise.

Step 6. Rotate PEAK SENS. control (E) clockwise until visual PEAK indicator I102 glows. Then rotate PEAK SENS. control (E) counterclockwise until I102 just ceases to light. (The visual null circuit is now adjusted to its most sensitive operating point for the detection of the calibrator pulse.)

Step 7. Turn PEAK control (C) counterclockwise until the visual PEAK indicator I102 blinks in unison with pulses emitted by calibrator (headphones may be used for aural identification). Then rotate PEAK control clockwise until I102 just ceases to blink. Note M101 indication on db scale and record.

Note

The aural null method may be used to verify visual null measurement of calibrator pulse amplitude.

Step 8. Repeat Steps 3 through 7 for each of the test frequencies in Bands 1 through 4.

Step 9. Using vertical scale of Charts No. 1 and No. 2, plot the values of calibrator pulse amplitude in db which were determined in Step 7. Draw a smooth curve through the plotted points.

Step 10. Repeat steps 3 and 4 at the test frequency of 145 megacycles in Band 5. Then reduce signal generator output to zero. If M101 indication is less than one microvolt, use 100-microvolt signal generator output as suggested in Step 3. If M101 indication is greater than one microvolt, use a signal generator output of 200 microvolts in Step 3.

Step 11. Repeat Steps 3 through 7 for each of the test frequencies in Band 5, but using signal generator output indicated by Step 10. If 100 microvolts are used, the correction factor for Band 5 will be 1. If 200 microvolts are used, the correction factor for Band 5 will be 2.

Step 12. Using the vertical scale of Charts No. 1 and No. 2, plot the values of calibrator amplitude in db which were determined in Step 7. Draw a smooth curve through the plotted points.

Step 13. For test frequencies in Band 6, a different procedure will be used as the sensitivity will not reach the 1-microvolt level.

To achieve maximum sensitivity capabilities of this band, operate with a signal-to-noise ratio of unity. This means the noise level will be maintained at 1 microvolt. Take data as follows:

Step *a*. Attenuator control (A) to CAL position.

Step *b*. Function switch (B) to CAL position.

Step *c*. Adjust CALIBRATE control (D) to extreme counterclockwise position.

Step *d*. Rotate PEAK control (C) for output meter indication of approximately full scale.

Step *e*. Turn PEAK SENS. control (E) clockwise until PEAK indicator lamp glows. Then counterclockwise until the lamp just ceases to glow.

Step *f*. Turn function switch (B) to FIELD INTENSITY position.

Step *g*. Adjust CALIBRATE control (D) for an indication of 1 microvolt on output meter.

Step *h*. Turn function switch (B) to CAL position.

Step *i*. Adjust PEAK control (C) counterclockwise until indicator lamp blinks at calibrator pulse frequency. Then turn clockwise until lamp just ceases to blink. Note M101 indication on db scale and record.

Step *j*. PULL-TURN-PUSH attenuator (A) to X1 position.

Step *k*. Turn function switch (B) to FIELD INTENSITY.

Step *l*. Adjust signal generator to RI-FI Meter frequency. Carefully adjust for maximum meter indication. Adjust signal generator output (unmodulated) for an output meter indication of 100 microvolts. Record signal generator output reading in microvolts. The correction factor will be

$$K = \frac{\text{signal generator reading (microvolts)}}{100}$$

Step *m*. A chart can now be made. The ordinate will be a linear scale marked off in frequencies (240 to 400 megacycles). There will be two abscissas. The one on left will be calibration readings in db. The one on right will be correction factor in units (1 to 10). Plot the data taken above, using left scale for data in Step 9 and using scale on right for factor determined in Step 12.

Step *n*. Repeat Steps *a* through *m* for each calibrating frequency.

Step *o*. Draw smooth curve through each set of points plotted above.

(3) Chart No. 3, an antenna adjustment table, Charts No. 4 and No. 5, antenna pick-up device factors, and Chart No. 8, signal plus noise chart, are not influenced by realignment of the RI-FI Meter. No corrections need be made.

TABLE 7–3. ELECTRON TUBE OPERATING VOLTAGES

Note

1. All numbers within parentheses designate pin numbers.
2. All measurements are made with a 20,000 ohm/voltmeter and with attenuator on X1; function switch on FIELD INTENSITY; PEAK, CALIBRATE, PEAK SENS., and AUDIO controls in their maximum counterclockwise positions unless otherwise indicated.
3. The above voltages are typical and will vary with different units.
4. All measurements are made from point indicated to chassis, except heater voltages which are measured across tube socket heater connections.

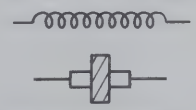
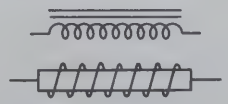
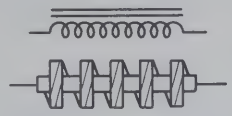
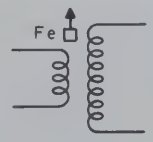
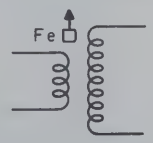
SYMBOL	TUBE	FUNCTION	PLATE (Voltage)	SCREEN (Voltage)	SUPP. (Voltage)	CATHODE (Voltage)	GRID (Voltage)	HEATER (Voltage)
V101	5840	R-f Amplifier	88	86	0	0	−0.65	6.3
V102	5840	R-f Amplifier	88	86	0	0	−0.3	6.3
V103	5840	Mixer	66	25	0	0	−0.2	6.3
V104	5840	Mixer	66	25	0	0	−0.2	6.3
V105	5718	Local Oscillator	126	—	–	0	−0.15	6.3
V106	6BH6	1st I-f Amplifier	220	212	0	12	0	6.3
V107	6BH6	2nd I-f Amplifier	220	185	0	4.4	0	6.3
V108	6BH6	3rd I-f Amplifier	220	188	0	4.4	0	6.3
V109	6BH6	4th I-f Amplifier	220	163	0	1.3	0	6.3
V110	6005	5th I-f Ampifier	205	196	13	13	0	6.3
V111	5726	Detector	***(2) −0.1 (7) −0.05	—	–	(1) 0.45 (6) 0.45	—	6.3
V112	6135	BFO	*128	—	–	* 0	*0.75	6.3
V113	6AU6WA	Video Amplifier	123	156	0	1.55	0	6.3
V114	6135	Audio Amplifier	218	—	–	7.3	0	6.3
V115	6BH6	Pulse Amplifier	218	155	0	1.1	0	6.3
V116	5814	Trigger Multivibrator	(1) 112 (6) 223	—	–	(3) 47 (8) 47	(2) 36 (7) 18	6.3
V117	6BH6	Pulse Amplifier	222	223	0	0	−39	6.3
V119	6135	VTVM	110	—	–	3.5	0	6.3
V120	6135	VTVM	110	—	–	3.5	0	6.3
V121	5814	Impulse Generator	**(1) 150 (6) 150	—	–	** (3) −76 (8) −76	**(2) −40 (7) −72	6.3
V122	OA2	Voltage Regulator	150	—	–	0	—	—
V301	5R4GY	Rectifier	(4) 340 (ac) (6) 340 (ac)	—	–	(2) 367 (8) 367	—	5.0
V302	6080	Voltage Regulator	(2) 367 (5) 367	—	–	(3) 225 (6) 225	(1) 160 (4) 160	(7) 6.3 (8) 6.3
V303	5651	Voltage Regulator	87	—	–	0	—	—
V304	OB2	Voltage Regulator	0	—	–	−108	—	—
V305	6AU6WA	Control Regulator	160	87	0	0	(1) −3.5	6.3

*Function switch in BFO position.

**Function switch in CAL position.

***Function switch in QP position.

TABLE 7–4. WINDING DATA

SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
L101 L102 L103	10617		ONE WINDING (AIR FORM)	NO. 24	21	LOW	——	—	SOLENOID WOUND $\frac{3}{32}$ ID X $\frac{1}{2}$ LONG
L104 L105	10360		SINGLE PIE UNIVERSAL WOUND	NO. 39 SNE	51	2.25	——	—	10 UH UNIVERSAL
L106	10692		ONE WINDING	NO. 38	110	3	——	—	SOLENOID WOUND
L107	90825-1		5 PIES UNIVERSAL WOUND	NO. 39 SNE	220 PER PIE	90	——	—	19.2 MH
L401 L402	10249		VARIABLE WIRE WOUND TOROIDAL	—	—	LOW	——	—	3.6 UH *
T101	90841-1		PRIMARY SECONDARY	NO. 32 NO. 32	2 26	LOW LOW	—— ——	— —	SOLENOID WOUND SOLENOID WOUND
T102	90842-1		PRIMARY SECONDARY	NO. 30 NO. 24	2 18	LOW LOW	—— ——	— —	SOLENOID WOUND SOLENOID WOUND

* DO NOT REPAIR. REPLACE ASSEMBLY WHEN NECESSARY

TABLE 7–4. WINDING DATA (Cont'd)

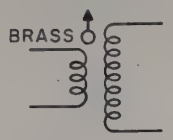
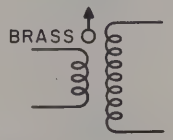
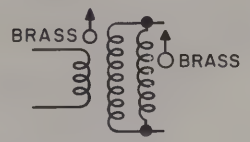
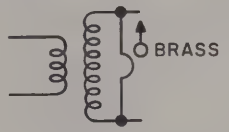
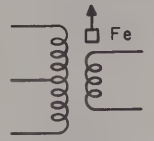
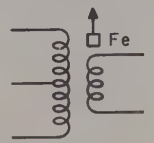
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T103	90843-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	10	LOW	——	——	SOLENOID WOUND
T104	90844-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	5	LOW	——	——	SOLENOID WOUND
T105	90845-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SHUNT SECONDARY	NO. 24	11	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	3	LOW	——	——	SOLENOID WOUND
T106	90846-1		PRIMARY	NO. 30	2	LOW	——	——	SOLENOID WOUND
			SHUNT SECONDARY	NO. 24	8	LOW	——	——	SOLENOID WOUND
			SECONDARY	COPPER STRAP	1	LOW	——	——	——
T111	90851-1		PRIMARY	NO. 32	25	LOW	——	——	SOLENOID WOUND CENTER TAP
			SECONDARY	NO. 32	1	LOW	——	——	SOLENOID WOUND
T112	90852-1		PRIMARY	NO. 24	18	LOW	——	——	SOLENOID WOUND CENTER TAP
			SECONDARY	NO. 30	1	LOW	——	——	SOLENOID WOUND

TABLE 7–4. WINDING DATA (Cont'd)

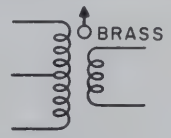
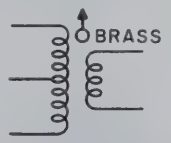
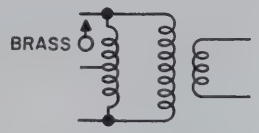
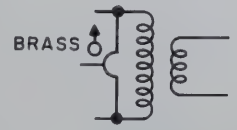
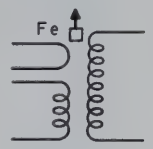
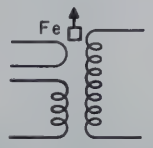
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D–C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A–C VOLTS	REMARKS
T113	90853-1		PRIMARY	NO. 24	10	LOW	——	——	SOLENOID WOUND CENTER TAP
			SECONDARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
T114	90854-1		PRIMARY	NO. 24	5	LOW	——	——	SOLENOID WOUND CENTER TAP
			SECONDARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
T115	90855-1		PRIMARY	NO. 30	3	LOW	——	——	SOLENOID WOUND CENTER TAP
			SHUNT SECONDARY	NO. 24	11	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	1	LOW	——	——	SOLENOID WOUND
T116	90856-1		PRIMARY	COPPER STRAP	1	LOW	——	——	COPPER STRAP CENTER TAP
			SHUNT PRIMARY	NO. 24	9	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
T121	90861-1		PRIMARY	NO. 32	2	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 32	25	LOW	——	——	SOLENOID WOUND
			TERTIARY	NO. 32	1	LOW	——	——	SOLENOID WOUND
T122	90862-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	18	LOW	——	——	SOLENOID WOUND
			TERTIARY	NO. 30	2	LOW	——	——	SOLENOID WOUND

TABLE 7–4. WINDING DATA (Cont'd)

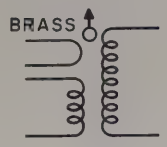
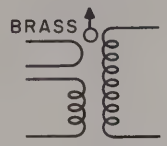
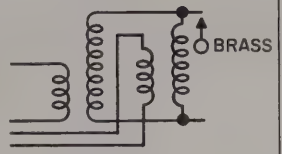
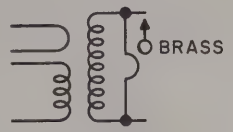
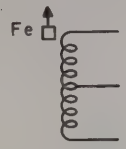
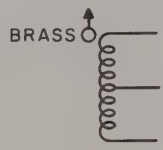
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T123	90863-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	10	LOW	——	——	SOLENOID WOUND
			TERTIARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
T124	90864-1		PRIMARY	NO. 30	1	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	5	LOW	——	——	SOLENOID WOUND
			TERTIARY	NO. 30	2	LOW	——	——	SOLENOID WOUND
T125	90865-1		PRIMARY	NO. 30	2	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 24	2	LOW	——	——	SOLENOID WOUND
			SHUNT SECONDARY	NO. 24	11	LOW	——	——	SOLENOID WOUND
			TERTIARY	NO. 30	4	LOW	——	——	SOLENOID WOUND
T126	90866-1		PRIMARY	NO. 30	2	LOW	——	——	SOLENOID WOUND
			SHUNT SECONDARY	NO. 24	9	LOW	——	——	SOLENOID WOUND
			SECONDARY	COPPER STRAP	1	LOW	——	——	——
			TERTIARY	NO. 30	2	LOW	——	——	SOLENOID WOUND
T131	90871-1		ONE WINDING	NO. 32	12	LOW	——	——	UNIVERSAL WOUND CENTER TAP
T132	90872-1		SECONDARY	NO. 24	15	LOW	——	——	SOLENOID WOUND CENTER TAP

TABLE 7–4. WINDING DATA (Cont'd)

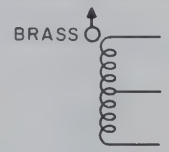
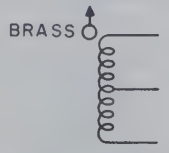
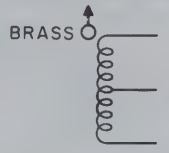
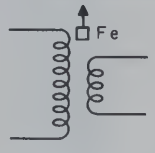
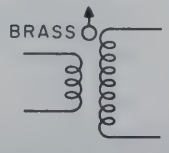
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T133	90873-1		ONE WINDING	NO. 24	8	LOW	——	——	SOLENOID WOUND CENTER TAP
T134	90874-1		ONE WINDING	NO. 24	4	LOW	——	——	SOLENOID WOUND CENTER TAP
T135	90875-1		ONE WINDING	NO. 24	3	LOW	——	——	SOLENOID WOUND CENTER TAP
T136	90876-1		ONE WINDING	$\frac{1}{8}$ STRAP	U-SHAPE	LOW	——	——	U-SHAPE STRAP CENTER TAP
T150	90837-1		PRIMARY SECONDARY	NO. 30 NO. 30	31 2	LOW LOW	—— ——	—— ——	SOLENOID WOUND SOLENOID WOUND
T151	90840-1		PRIMARY SECONDARY	NO. 31 NO. 31	3 16	LOW LOW	—— ——	—— ——	SOLENOID WOUND SOLENOID WOUND

TABLE 7–4. WINDING DATA (Cont'd)

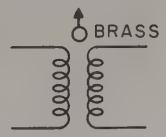
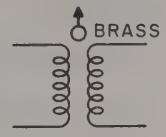
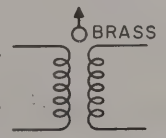
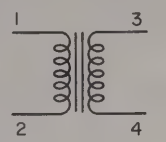
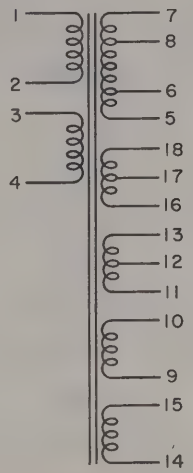
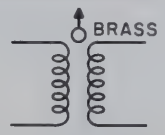
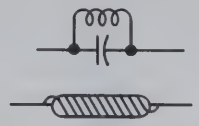
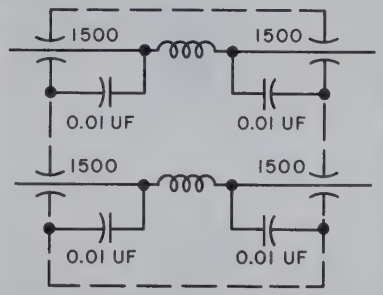
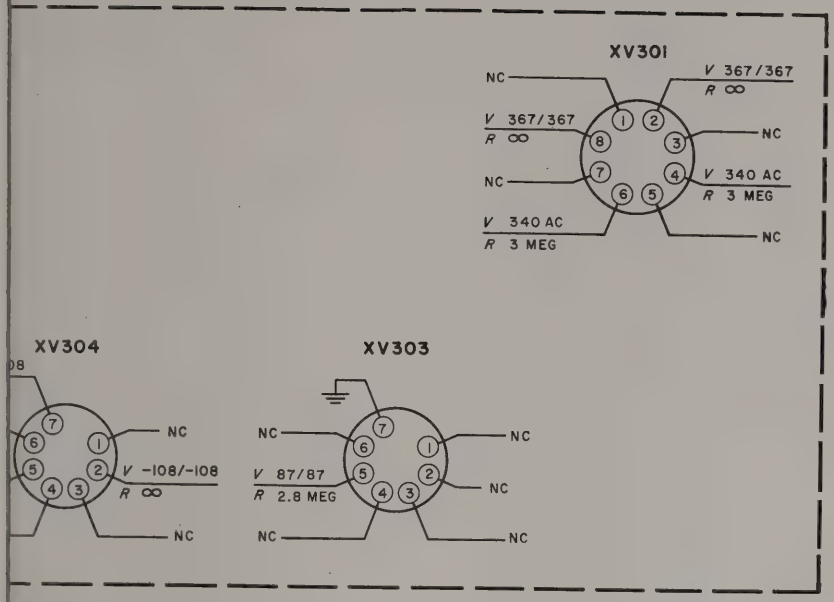
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T152	90850-1		PRIMARY	NO. 31	14	LOW	——	——	SOLENOID WOUND
T153	90850-1		SECONDARY	NO. 31	14	LOW	——	——	SOLENOID WOUND
T154	90948-1		PRIMARY	NO. 31	15	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 31	15	LOW	——	——	SOLENOID WOUND
T156	90860-1		PRIMARY	NO. 31	14	LOW	——	——	SOLENOID WOUND
			SECONDARY	NO. 31	12	LOW	——	——	SOLENOID WOUND
T157	10128		PRIMARY 1-2	41E	3600	860	1 TO 0.06	1000V	IMPEDANCE 10K
T158			SECONDARY 3-4	36E	960	95		1000V	IMPEDANCE 600 OHMS
T301	10689		PRIMARY 1-2	NO. 23	220	3.2	——	900	——
			PRIMARY 3-4	NO. 23	220	3.45	——	900	——
			SECONDARY 5-7	NO. 28	1420	80	——	1400	——
			SECONDARY 9-10	NO. 25	13	0.4	——	500	——
			SECONDARY 11-13	NO. 18	13	0.08	——	500	——
			SECONDARY 14-15	NO. 16	24	0.1	——	500	——
			SECONDARY 16-18	NO. 19	10	0.085	——	1200	——

TABLE 7–4. WINDING DATA (Cont'd)

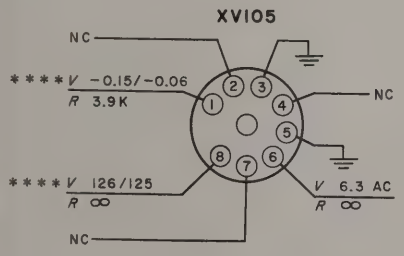
SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T155	90982-1		PRIMARY SECONDARY	NO. 31 NO. 31	14 14	LOW LOW	— —	— —	SOLENOID WOUND SOLENOID WOUND
Z101 THROUGH Z106	90839-1		SINGLE	NO. 25	15	LOW	—	—	SOLENOID WOUND ON CAPACITOR 200 UUF RESONATES AT 15 MC
Z115	91033-1	COAXIAL LINE, LOW PASS FILTER-NO WINDINGS	—	—	—	—	—	—	—
Z301	90807-1	 CAPACITANCE VALUES ARE IN MICROMICROFARADS UNLESS MARKED UF UF = MICROFARADS	—	24	19	LOW	—	—	*

* DO NOT REPAIR. REPLACE ASSEMBLY WHEN NECESSARY



R-F HEAD

CATED UNDERNEATH I-F
ASSIS AS VIEWED FROM
E REAR)



CONDITIONS OF MEASUREMENT

1. ALL MEASUREMENTS ARE MADE FROM POINT SHOWN TO CHASSIS.
2. ALL VOLTAGE MEASUREMENTS ARE MADE WITH BOTH 20,000 AND 1,000 OHM/VOLT METERS. THE 20,000 OHM/VOLT READING IS GIVEN FIRST, FOLLOWED BY THE 1,000 OHM/VOLT READING.
3. READINGS FOLLOWED BY "AC" WERE OBTAINED WITH A 1,000 OHM/VOLT A-C VOLTMETER.
4. ALL VOLTAGE AND RESISTANCE MEASUREMENTS WERE MADE WITH ALL FRONT PANEL POTENTIOMETERS FULLY COUNTERCLOCKWISE.
5. ALL MEASUREMENTS MADE WITH THE ATTENUATOR IN **XI** POSITION AND FUNCTION SWITCH IN **FIELD INTENSITY** POSITION UNLESS OTHERWISE SPECIFIED.
6. ALL RESISTANCE MEASUREMENTS ARE MADE WITH THE POWER SUPPLY DISCONNECTED FROM THE RI-FI METER AND WITH ALL TUBES AND INDICATOR LIGHTS REMOVED.

NOTES:

* DEPENDS ON SETTINGS OF CHASSIS CONTROL. DO NOT CHANGE CONTROL SETTINGS EXCEPT IN ALIGNMENT AND CALIBRATION PROCEDURES.

** FUNCTION SWITCH IN **BFO** POSITION.

*** FUNCTION SWITCH IN **CAL** POSITION.

**** DEPENDS ON FREQUENCY DIAL SETTING.

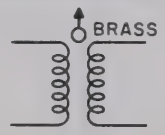
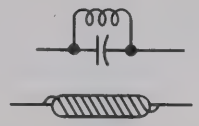
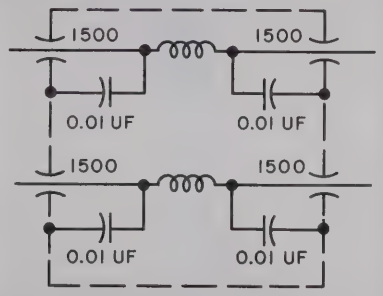
***** FUNCTION SWITCH IN **QP** POSITION.

• 6.3 VOLTS AC MEASURED BETWEEN PINS 3 AND 4. NO POTENTIAL BETWEEN EITHER PIN AND CHASSIS. RESISTANCE TO CHASSIS FROM EITHER PIN IS INFINITY.

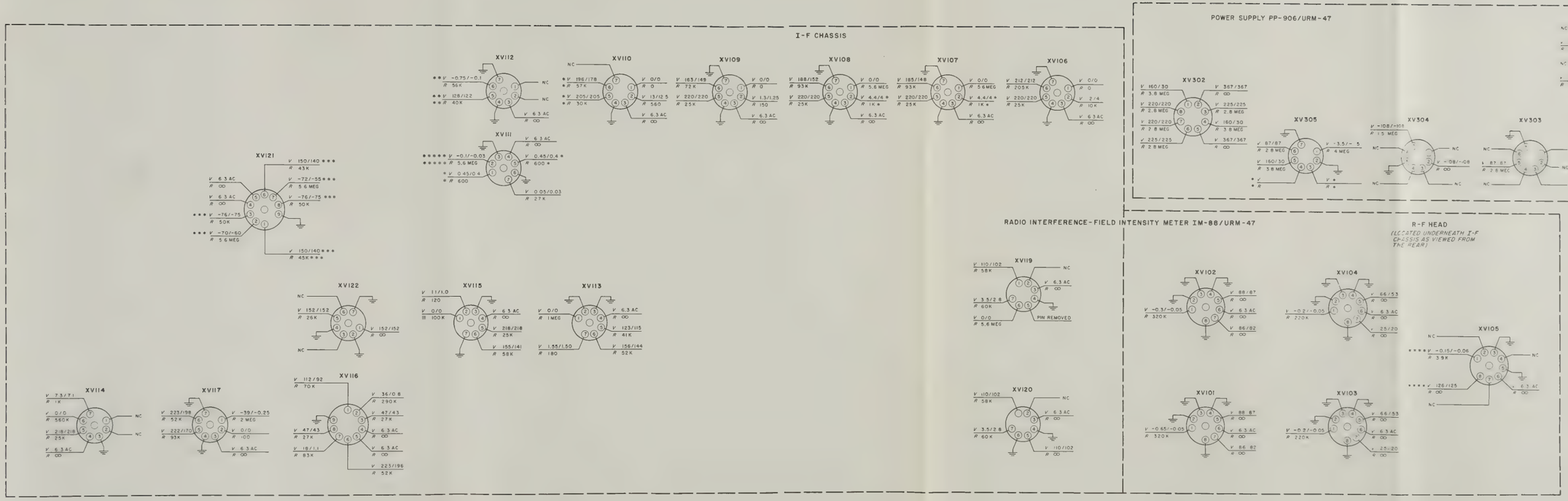
K = 1,000 OHMS
MEG = 1,000,000 OHMS
V INDICATES D-C VOLTAGE TO GROUND UNLESS OTHERWISE SPECIFIED.
R INDICATES D-C RESISTANCE TO GROUND.
∞ = INFINITY
NC = NO CONNECTION

Figure 7–11. Radio Interference Measuring Set AN/URM-47, Voltage and Resistance Data

TABLE 7–4. WINDING DATA (Cont'd)

SYMBOL DESIGNATION	STODDART PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (OHMS)	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T155	90982-1		PRIMARY SECONDARY	NO. 31 NO. 31	14 14	LOW LOW	— —	— —	SOLENOID WOUND SOLENOID WOUND
Z101 THROUGH Z106	90839-1		SINGLE	NO. 25	15	LOW	—	—	SOLENOID WOUND ON CAPACITOR 200 UUF RESONATES AT 15 MC
Z115	91033-1	COAXIAL LINE, LOW PASS FILTER-NO WINDINGS	—	—	—	—	—	—	—
Z301	90807-1	 CAPACITANCE VALUES ARE IN MICROMICROFARADS UNLESS MARKED UF UF = MICROFARADS	—	24	19	LOW	—	—	*

* DO NOT REPAIR. REPLACE ASSEMBLY WHEN NECESSARY



CONDITIONS OF MEASUREMENT

ALL MEASUREMENTS ARE MADE FROM POINT SHOWN TO CHASSIS

✓ ALL VOLTAGE MEASUREMENTS ARE MADE WITH BOTH 20,000 AND 1,000 OHM/VOLT METERS THE 20,000 OHM/VOLT READING IS GIVEN FIRST, FOLLOWED BY THE 1,000 OHM/VOLT READING

x READINGS FOLLOWED BY "AC" WERE OBTAINED WITH A 1,000 OHM/VOLT A-C VOLTMETER

4 ALL VOLTAGE AND RESISTANCE MEASUREMENTS WERE MADE WITH ALL FRONT PANEL POTENTIOMETERS FULLY COUNTERCLOCKWISE

5 ALL MEASUREMENTS MADE WITH THE ATTENUATOR IN **XI** POSITION AND FUNCTION SWITCH IN **FIELD INTENSITY** POSITION UNLESS OTHERWISE SPECIFIED

6 ALL RESISTANCE MEASUREMENTS ARE MADE WITH THE POWER SUPPLY DISCONNECTED FROM THE RI-71 METER AND WITH ALL TUBES AND INDICATOR LIGHTS REMOVED

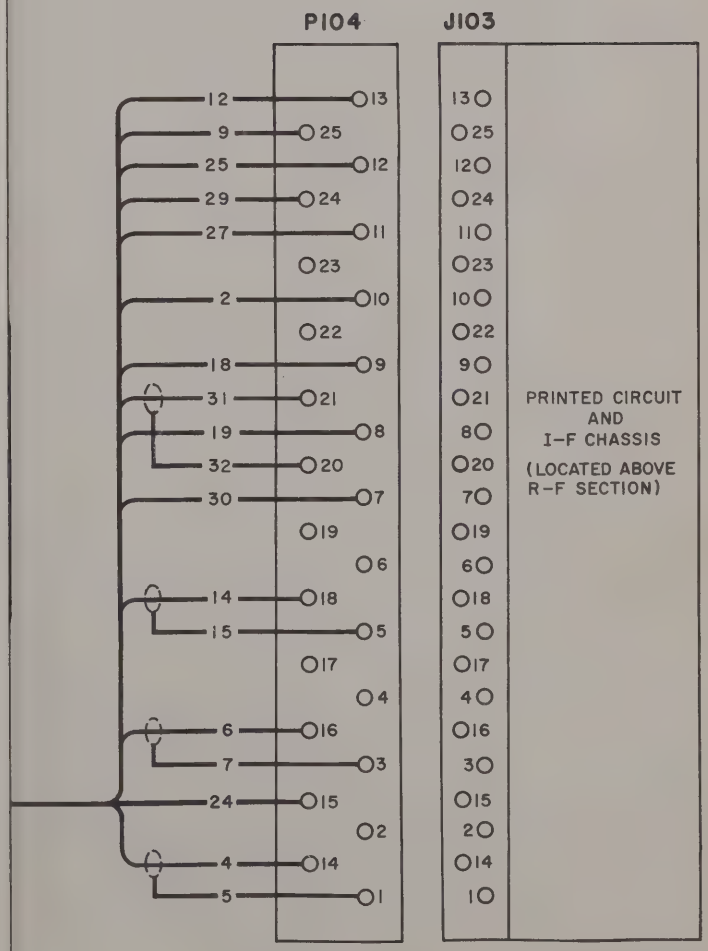
NOTES:

* DEPENDS ON SETTINGS OF CHASSIS CONTROL. DO NOT CHANGE CONTROL SETTINGS EXCEPT IN ALIGNMENT AND CALIBRATION PROCEDURES.
** FUNCTION SWITCH IN **BFO** POSITION
*** FUNCTION SWITCH IN **CAL** POSITION
**** DEPENDS ON FREQUENCY DIAL SETTING
***** FUNCTION SWITCH IN **OP** POSITION

• 6.3 VOLTS AC MEASURED BETWEEN PINS 3 AND 4
NO POTENTIAL BETWEEN EITHER PIN AND CHASSIS
RESISTANCE TO CHASSIS FROM EITHER PIN IS INFINITY.

K = 1,000 OHMS
MEG = 1,000,000 OHMS
V INDICATES D-C VOLTAGE TO GROUND UNLESS OTHERWISE SPECIFIED
R INDICATES D-C RESISTANCE TO GROUND
∞ = INFINITY
NC = NO CONNECTION

Figure 7–11. Radio Interference Measuring Set AN/URM-47, Voltage and Resistance Data



2. Radio Interference-Field Intensity Meter IM-88/URM-47, Wiring Diagram

WIRE RUNNING LIST

WIRE NO.	FROM	TO	COLOR
1	METER (+) M101	C278	RED
2	METER (−) M101	P104 (10)	BLACK
3	I102	TIE POINT	RED
4	I102	P104 (14)	SHIELDED WIRE
5	GROUND POST	P104 (1)	WIRE BRAID
6	CENTER R191	P104 (16)	SHIELDED WIRE
7	GROUND POST	P104 (3)	WIRE BRAID
8	P109 (A)	J106 (A)	BROWN
9	P109 (B)	P104 (25)	RED
10	P109 (C)	TIE POINT	WHITE
11	P109 (D)	GROUND POST	BLACK
12	S103	P104 (13)	WHITE
13	S103	TIE POINT	RED
14	J107	P104 (18)	SHIELDED WIRE
15	GROUND POST	P104 (5)	WIRE BRAID
16	TIE POINT	J106 (B)	RED
17	TIE POINT	J106 (B)	RED
18	TIE POINT	P104 (9)	RED
19	CENTER R128	P104 (8)	YELLOW
20	NOT USED		
21	GROUND POST	J106 (D)	BLACK
22	C228	R216	RED
23	NOT USED		
24	J106 (E)	P104 (15)	BLACK
25	R215	P104 (12)	RED
26	GROUND POST	RIGHT R231	BLACK
27	CENTER R231	P104 (11)	BLUE
28	TIE POINT	J106 (C)	WHITE
29	J106 (C)	P104 (24)	WHITE
30	J106 (A)	P104 (7)	BROWN
31	TIE POINT	P104 (21)	SHIELDED WIRE
32	J108 GROUND	P104 (20)	WIRE BRAID

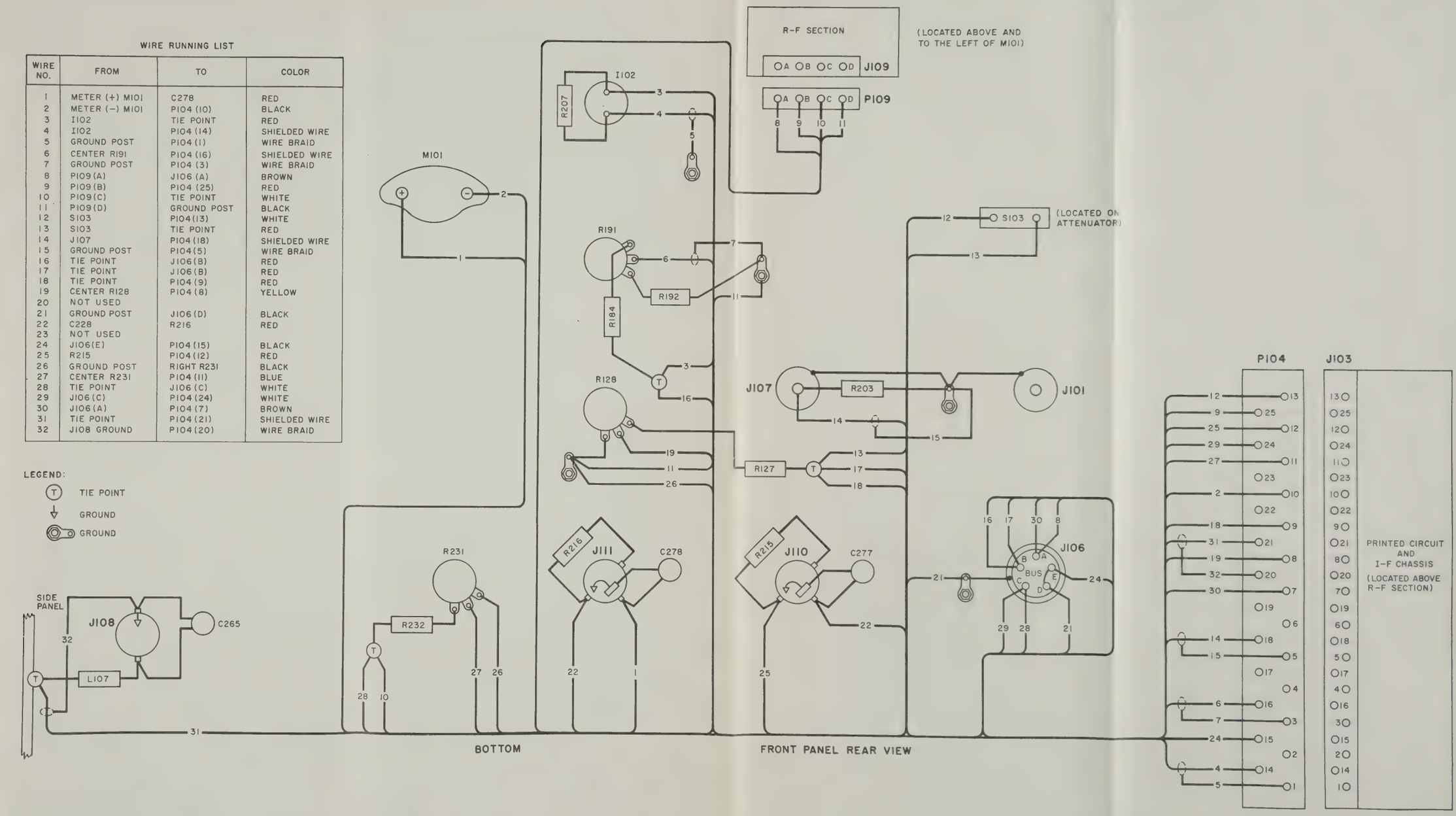
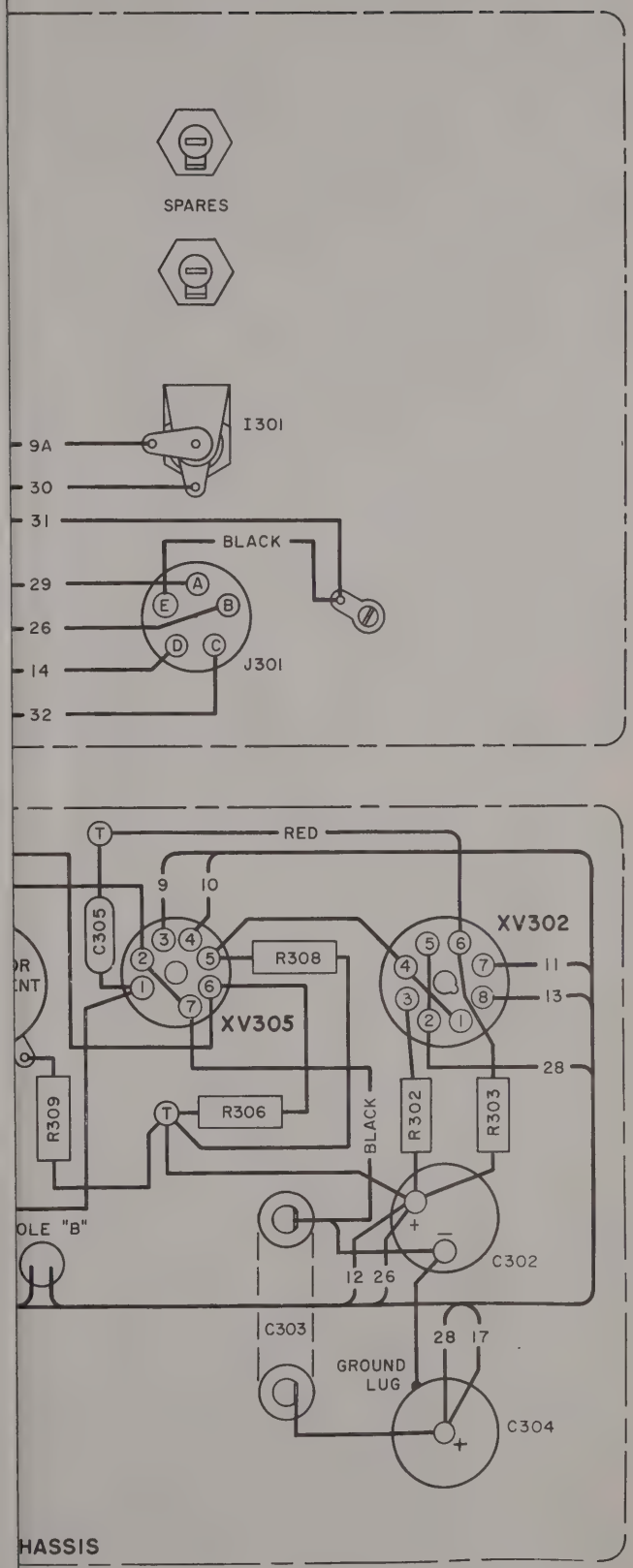


Figure 7—12. Radio Interference-Field Intensity Meter IM-88/URM-47, Wiring Diagram

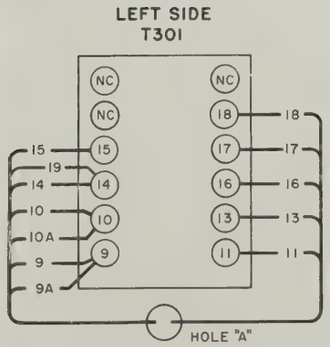


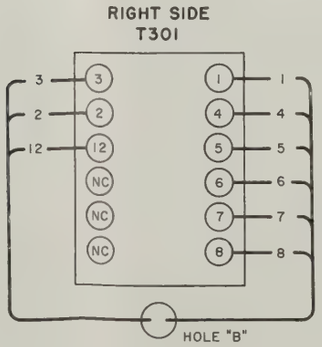
er Supply PP-906/URM-47, Wiring Diagram

CABLE WIRE RUNNING LIST			
WIRE NO.	FROM	TO	COLOR
1	T301(1)	S302(6)	GRAY
2	T301(2)	S302(2)	GRAY
3	T301(3)	S302(5)	GRAY
4	T301(4)	S302(3)	GRAY
5	T301(5)	XV301(6)	BLUE
6	T301(6)	R304	BLACK
7	T301(7)	XV301(4)	BLUE
8	T301(8)	CR301(+)	WHITE
9	T301(9)	XV305(3)	BROWN
9A	T301(9A)	I301	BROWN
10	T301(10)	XV305(4)	BROWN
10A	T301(10A)	XR301(6)	BROWN
11	T301(11)	XV302(7)	BROWN
12	T301(12)	C302(+)	RED
13	T301(13)	XV302(8)	BROWN
14	T301(14)	J301(D)	BLACK
15	T301(15)	R301(7)	BROWN
16	T301(16)	XV301(8)	BROWN
18	T301(18)	XV301(2)	BROWN
19	R304	T301(14)	BLACK
20	C308(−)	CR303(−)	WHITE
23	S302(3)	Z301	GRAY
24	S302(5)	J303	GRAY
25	S302(6)	Z301	GRAY
26	C302(+)	J301(B)	RED
28	C304(+)	XV302(2)	RED
29	XR301(2)	J301(A)	BROWN
30	XR301(5)	I301	BROWN
31	XV303 GROUND	PANEL GROUND	BLACK
32	V304(2)	J301(C)	WHITE

NOTE: WIRE JUMPERS ARE NOT INCLUDED IN THIS LIST

GROUND (T) INSULATED TIE POINT





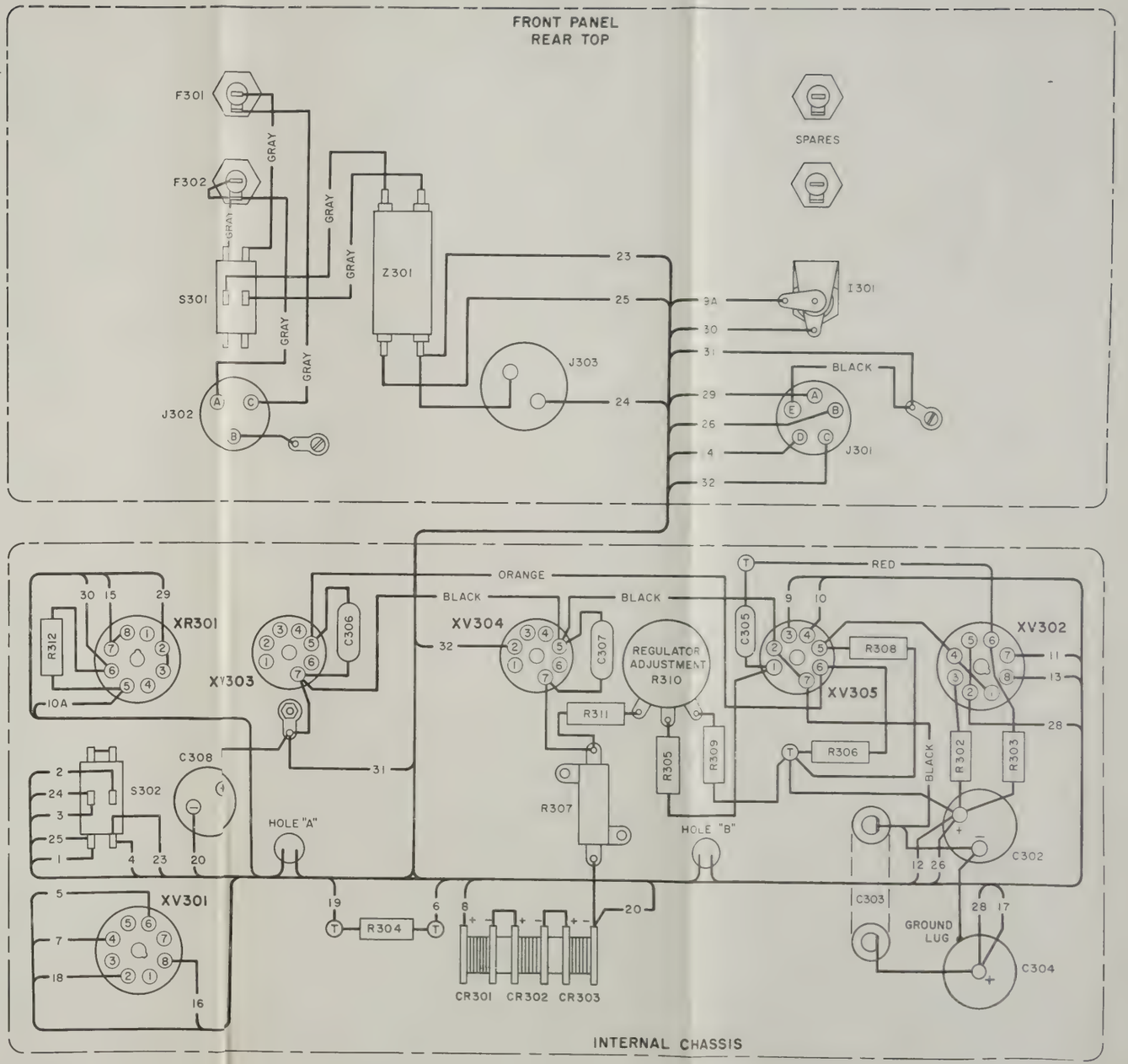
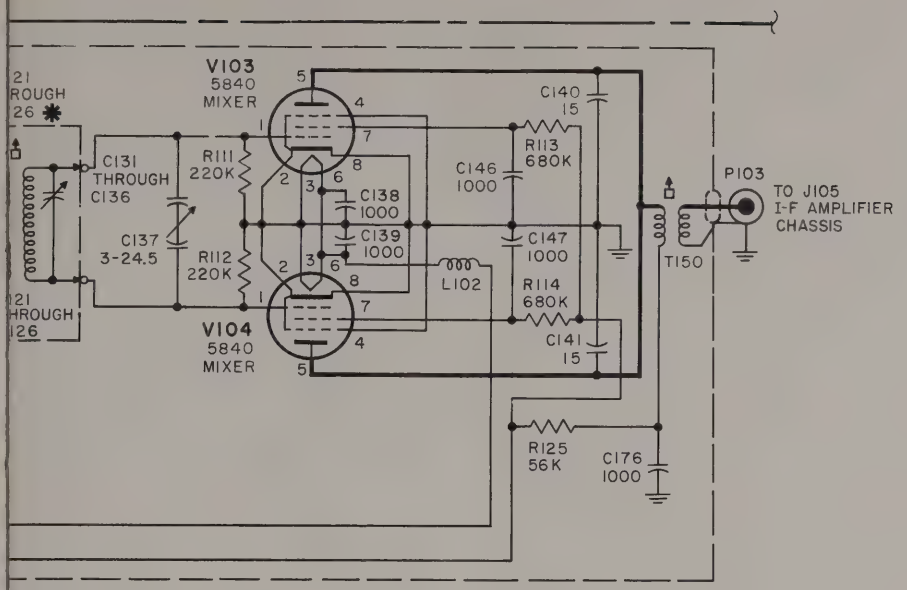


Figure 7–13. Power Supply PP-906/URM-47, Wiring Diagram



NOTES:
UNLESS OTHERWISE INDICATED:
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
K = 1,000 OHMS
MEG = 1,000,000 OHMS
UH = MICROHENRIES
UF = MICROFARADS

ALL FEEDTHROUGH CAPACITORS ARE 1500 MICROMICROFARADS
UNLESS OTHERWISE INDICATED

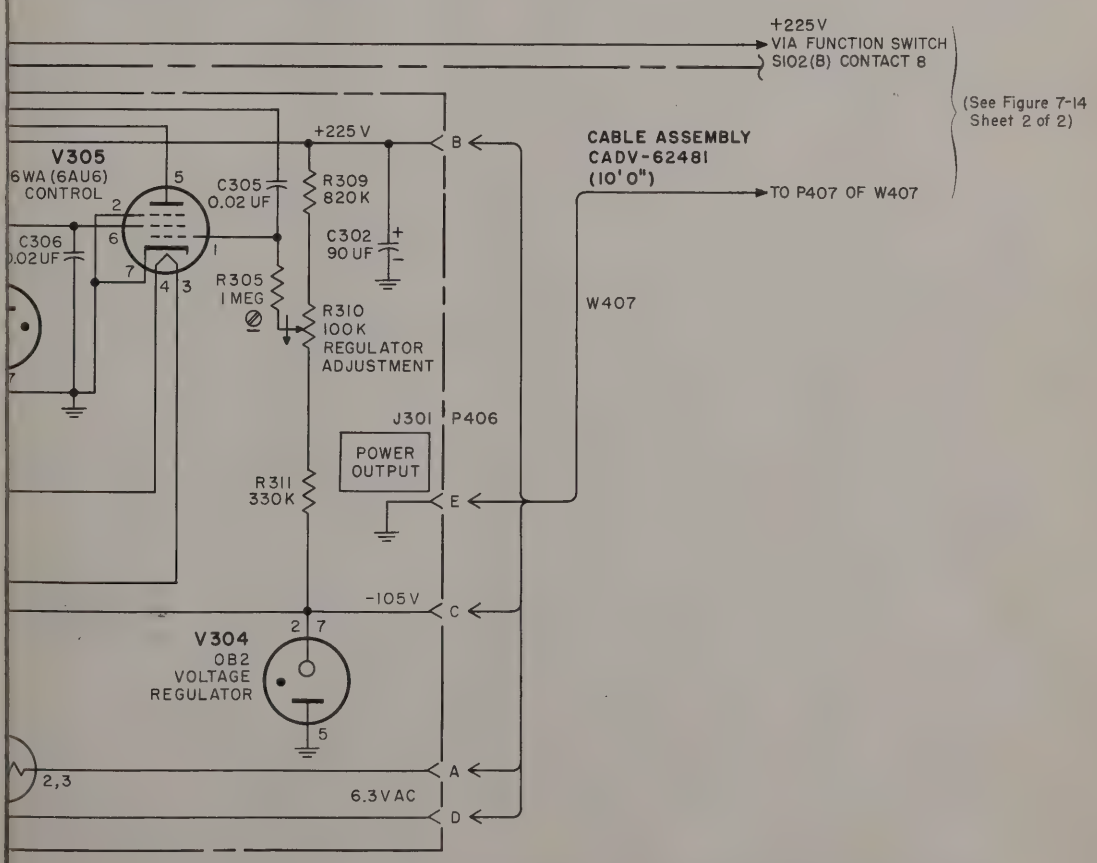


Figure 7–14. Radio Interference Measuring Set AN/URM-47, Complete Schematic Diagram (Sheet 1 of 2 Sheets)

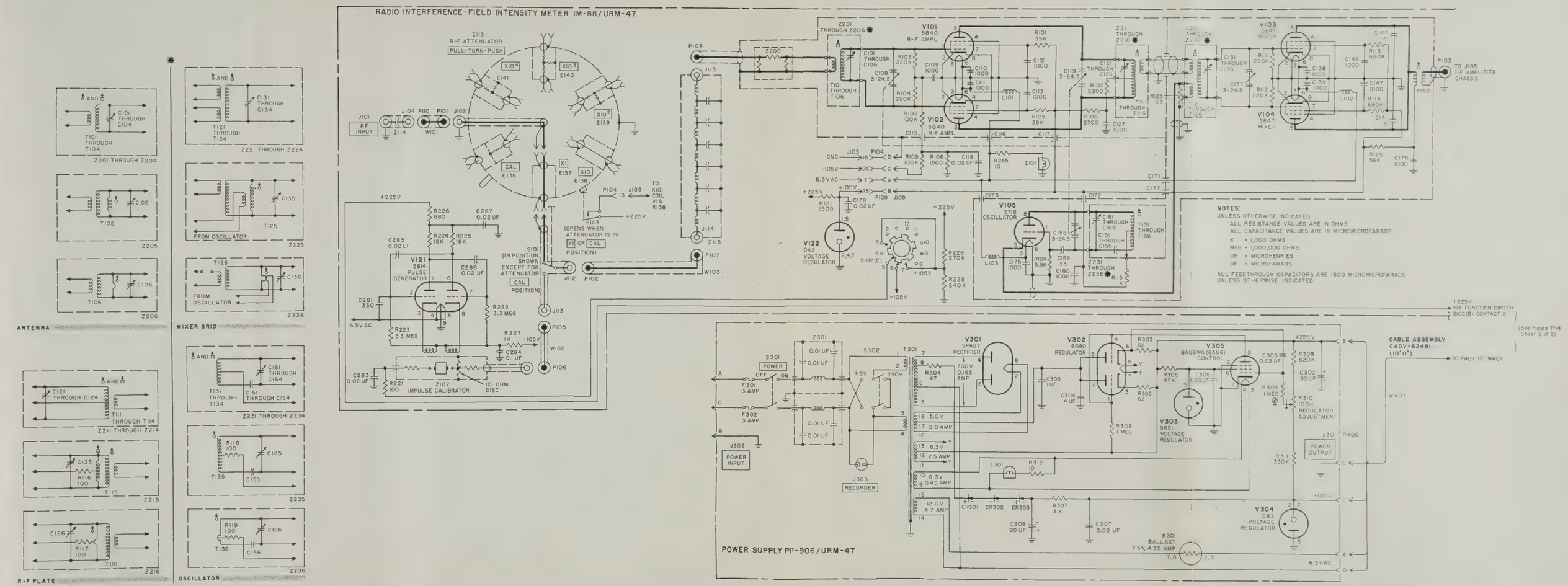


Figure 7–14. Radio Interference Measuring Set AN/URM-47, Complete Schematic Diagram (Sheet 1 of 2 Sheets)

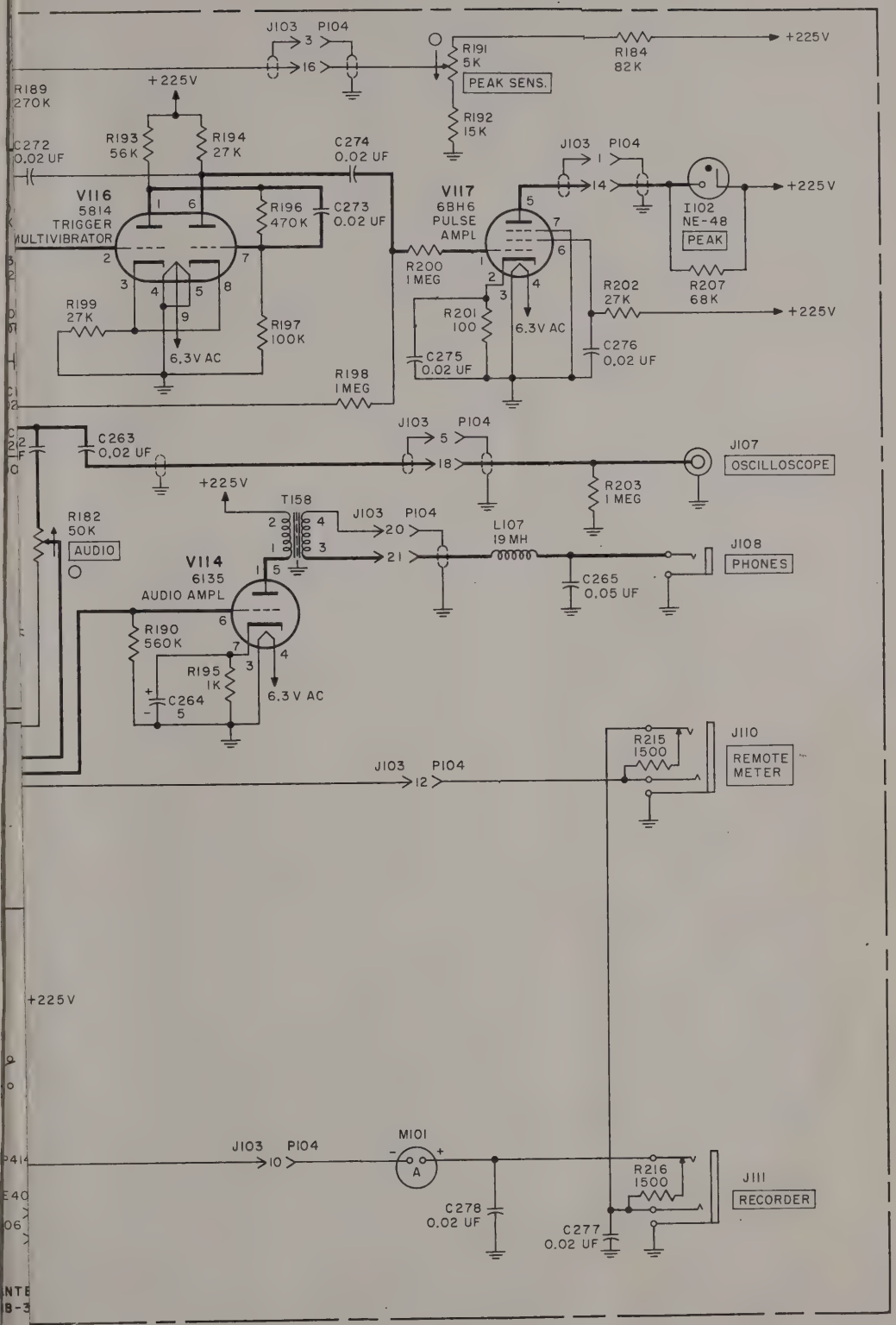


Figure 7—14. Radio Interference Measuring Set AN/URM-47, Complete Schematic Diagram (Sheet 2 of 2 Sheets)

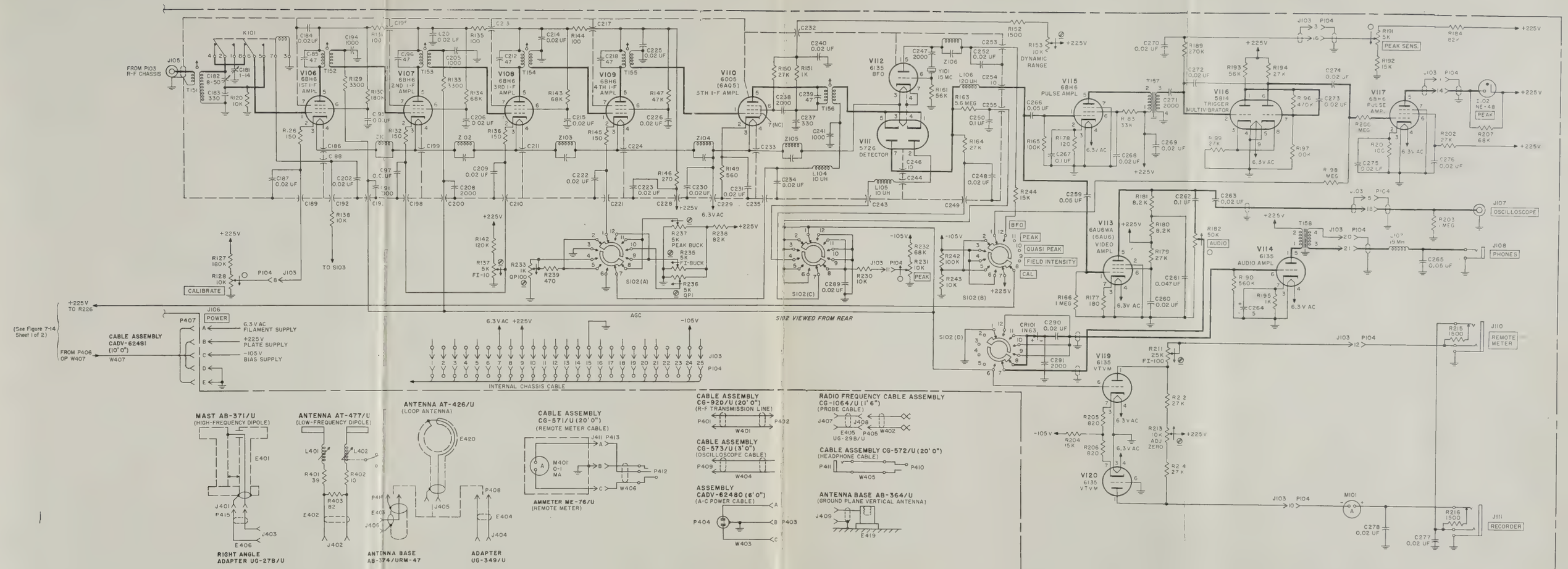


Figure 7–14. Radio Interference Measuring Set AN/URM-47, Complete Schematic Diagram (Sheet 2 of 2 Sheets)

SECTION 8
PARTS LISTS

TABLE 8–1. LIST OF MAJOR UNITS

SYMBOL GROUP	NAME OF MAJOR UNIT	NAVY TYPE	DESIGNATION
101–299	Radio Interference-Field Intensity Meter	—	IM-88/URM-47
301–399	Power Supply	—	PP-906/URM-47
401–499	Accessories	—	See table 1–1

TABLE 8–2. TABLE OF REPLACEABLE PARTS

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47	
101-299	— / F17-M-23353-7221 / —	RADIO INTERFERENCE-FIELD INTENSITY METER: Army-Navy type IM-88/URM-47; covers frequency range of 20 to 400 mcs in six bands; ± 2% frequency calibration accuracy; 50 ohms input impedance; microvolt db meter; operates from power supply PP-906/URM-47; CADV #90784-1	Radio interference-field intensity meter unit
C101		CAPACITOR, VARIABLE: approx 2 to 8 mmf; p/o Z201; (LISTED FOR REFERENCE ONLY)	Trimmer capacitor, T101 secondary
C102		Same as C101 (p/o Z202)	Trimmer capacitor, T102 secondary
C103		Same as C101 (p/o Z203)	Trimmer capacitor, T103 secondary
C104		Same as C101 (p/o Z204)	Trimmer capacitor, T104 secondary
C105		Same as C101 (p/o Z205)	Trimmer capacitor, T105 secondary
C106		CAPACITOR, VARIABLE: approx 1 to 6 mmf; p/o Z206; (LISTED FOR REFERENCE ONLY)	Trimmer capacitor, T106 secondary
C107		Not used	
C108	— / N16-C-62411-8001	CAPACITOR, VARIABLE: min effective capacity 3 mmf, max effective capacity approx 24.5 mmf; 800 vdcw; 1-7/32 in. lg by 1.547 in. h by 1.5 in. w; ccw rotation; front and back supporting plates Steatite; RGN-30 phenolic bearing supports; front bearing consists of eleven 0.093 in. dia glass ball bearings; rear bearing five identical balls; front and back stators ea five plates; front and back rotors ea six plates; CHC #34351-GI; CADV #10485	Antenna coil tuning capacitor
C109	3DA1-438 / ***N16-C-18630-3689 / —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 mmf; G.M.V. 500 vdcw; dipped phenolic insulation, wax impregnated; 3/16 in. by 3/16 in. by 0.080 in.; two wire leads 1/2 in. lg; CER #3801; CADV #10444	RF stage grid circuit decoupling
C110		Same as C109	Heater bypass, V101
C111		Same as C109	Heater bypass, V102
C112		Same as C109	Screen bypass, V101
C113		Same as C109	Screen bypass, V102
C114		Not used	
C115	— / N16-C-18787-8062 / —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1500 mmf, ± 20%; 500 vdcw; feedthru type; ceramic insulation, silicone-enamel finished ends; 3-1/4 in. lg by 5/16" in. hex; axial soft wire leads; Erie HI-K-12 temp coefficient; threaded 12-28 for mounting; CER #362-03; CADV #10364	Grid bias bypass, rf stage

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C116		Same as C115	Heater circuit bypass, rf stage
C117		Same as C115	B+ bypass, rf stage
C118	— ***N16-C-19143-3701 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: disc type; 20,000 mmf; 600 vdcw; tolerance GMV; 19/32 in. dia; 0.160 in. thk; color, red; marked "ER" and "0.02"; 2 radial wire leads 1-3/4 in. lg; similar to CER #817; CADV #10493	Grid bias bypass, rf stage
C119	— N16-C-62411-8011 —	CAPACITOR, VARIABLE, AIR DIELECTRIC: min effective capacity approx 3 mmf; max effective capacity approx 24.5 mmf; 800 vdcw; length 1-7/32 in. by 1.547 in. h by 1.5 in. w; clockwise rotation; front and back supporting plates Steatite; RGN-30 phenolic bearing supports; front bearing consists of eleven 0.093 in. dia glass ball bearings; rear bearing five identical balls; front and back stators ea five plates; front and back rotors ea six plates; CHC #34352-GI; CADV #10486	Tuning capacitor, rf amplifier plate circuit
C120		Not used	
C121		Same as C101 (p/o Z211)	Trimmer capacitor, T111 primary
C122		Same as C101 (p/o Z212)	Trimmer capacitor, T112 primary
C123		Same as C101 (p/o Z213)	Trimmer capacitor, T113 primary
C124		Same as C101 (p/o Z214)	Trimmer capacitor, T114 primary
C125		Same as C101 (p/o Z215)	Trimmer capacitor, T115 primary
C126		Same as C106 (p/o Z216)	Trimmer capacitor, T116 primary
C127		Same as C109	B+ bypass, rf amplifier
C128		Not used	
C129		Not used	
C130		Not used	
C131		Same as C101 (p/o Z221)	Trimmer capacitor, T121 secondary
C132		Same as C101 (p/o Z222)	Trimmer capacitor, T122 secondary
C133		Same as C101 (p/o Z223)	Trimmer capacitor, T123 secondary
C134		Same as C101 (p/o Z224)	Trimmer capacitor, T124 secondary

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C135		Same as C101 (p/o Z225)	Trimmer capacitor, T125 secondary
C136		Same as C106 (p/o Z226)	Trimmer capacitor, T126 secondary
C137		Same as C108	Tuning capacitor, mixing stage
C138		Same as C109	Heater bypass, V103
C139		Same as C109	Heater bypass, V104
C140	— ***N16-C-15978-6110 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 15 mmf, ± 15%; temp coefficient; ± 600 ppm/°C; not insulated; 500 vdcw; max dim. 0.400 in. lg by 0.200 in. dia; two radial wire leads, 2 in. lg; CER #CC20CH150J; CADV #10664-150	RF bypass, V103
C141		Same as C140	RF bypass, V104
C142		Not used	
C143		Not used	
C144		Not used	
C145		Not used	
C146		Same as C109	Screen bypass, V103
C147		Same as C109	Screen bypass, V104
C148		Not used	
C149		Not used	
C150		Not used	
C151	— N16-C-16549-7001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 47.7 mmf, ± 1%; 500 vdcw; porcelain enamel ceramic insulation; temp coefficient + 120 ± 5 ppm/°C; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; axial wire leads 1-1/4 in. lg; Vitramon type 70; CADV #10671	T131 padder
C152	— N16-C-16838-7841 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 74.4 mmf, ± 1%; 500 vdcw; porcelain enamel ceramic insulation; temp coefficient + 120 ± 5 ppm/°C; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; axial wire leads 1-1/4 in. lg; Vitramon type 70; CADV #10672	T132 padder
C153	— N16-C-17221-3881 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 120.8 mmf, ± 1%; 500 vdcw; porcelain enamel ceramic insulation; temp coefficient + 120 ± 5 ppm/°C; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; axial wire leads 1-1/4 in. lg; Vitramon type 70; CADV 10673	T133 padder

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)	
C154	— N16-C-17670-5861 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 197.7 mmf, ± 1%; 500 vdcw; porcelain enamel ceramic insulation; temp coefficient + 120 ± 5 ppm/°C; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; axial wire leads 1-1/4 in. lg; Vitramon type 70; CADV #10674	T134 padder
C155	— N16-C-17893-5681 —	CAPACITOR, FIXED: silvered mica dielectric; 323 mmf; ± 2% tolerance; 500 vdcw; max operating temp 150±C; wax impregnated; overall dim. 0.4606 in. by 0.447 in. dia (includes solder lugs by which capacitor is mounted); CER #370CC; CADV #10675	T135 padder
C156	— N16-C-29708-5134 —	CAPACITOR, FIXED: silvered mica dielectric; 750 mmf; ± 2% tolerance; 500 vdcw; max operating temp 150°C; wax impregnated; overall dim. 0.4606 in. by 0.447 in. dia (includes solder lugs by which capacitor is mounted); CER #370CC; CADV #10779	T136 padder
C157		Not used	
C158		Same as C119	Oscillator tuning capacitor
C159	— ***N16-C-16300-8001 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 33 mmf, ± 5%; temp coefficient negative 220 ± 60 ppm/°C; tubular; not insulated; 500 vdcw; max dim. 0.400 in. lg by 0.200 in. dia; two radial wire leads, 2 in. lg; CER #CC20RH330J; CADV #10735	V105 coupling capacitor
C160		Same as C109	B+ bypass, V105
C161		Same as C101 (p/o Z231)	Trimmer capacitor, T131 primary
C162		Same as C101 (p/o Z232)	Trimmer capacitor, T132 primary
C163		Same as C101 (p/o Z233)	Trimmer capacitor, T133 primary
C164		Same as C101 (p/o Z234)	Trimmer capacitor, T134 primary
C165		Same as C101 (p/o Z235)	Trimmer capacitor, T135 primary
C166		CAPACITOR, VARIABLE: ceramic dielectric; 1.0 to 14 mmf (LISTED FOR REFERENCE ONLY: p/o Z236)	Trimmer capacitor, T136 primary
C167		Not used	
C168		Not used	
C169		Not used	
C170		Not used	
C171		Same as C115	Heater circuit by-pass, mixer stage
C172		Same as C115	B+ bypass, V105

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C173		Same as C115	Heater circuit bypass, V105
C174		Not used	
C175		Same as C109	Heater bypass, V105
C176		Same as C109	RF bypass, T150
C177		Same as C115	B+ bypass, mixer stage
C178		Same as C118	B+ bypass, V122
C179		Not used	
C180		Not used	
C181	— / N16-C-63927-1376 / —	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 1.0 to 14 mmf; 600 vdcw; 3/4 in. lg by 7/32 in. dia; mts by brass tuning slug and Tinnerman nut; CADV #90787-1	IF attenuator trimmer
C182	— / N16-C-64133-6960	CAPACITOR, VARIABLE: 8 to 50 mmf; 350 vdcw; 3/4 in. lg by 17/32 in. w by 19/32 in. thk; two solder lug terminals; two 0.120 in. dia mtg holes in base on 5/16 in. centers; screwdriver slot adjustment; plastic base; spec JAN-C-20A; CER #557; CADV #10787	Attenuator series element
C183	— / N16-C-17903-6981 / —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 330 mmf, ± 1%; 500 vdcw; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; Vitramon type 71; CADV #10666-331	Attenuator shunt element
C184		Same as C118	RF bypass, T152 primary
C185	— / N16-C-16519-8934	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 47 mmf, ± 1%; 500 vdcw; max dim. 0.40 in. lg by 0.25 in. w by 0.24 in. thk; axial wire leads 1-1/4 in. lg; Vitramon type 70; CADV #10704-470	Tuning capacitor, T152 primary
C186		Same as C115	Heater bypass, V106
C187		Same as C118	Cathode bias bypass, V106
C188		Same as C115	Relay B+ bypass
C189		Same as C115	Cathode bias bypass, V106
C190		Same as C115	AGC bypass, V107
C191	— / N16-C-18884-4848 / —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: disc type; 2000 mmf, tolerance + 100%; 500 vdcw; 3/8 in. max dia by 1/8 in. thk; radial wire leads 1-3/4 in. max lg; color, red; markings "ER" and "0.002"; CER #801-.002; CADV #10668	AGC bypass, V107
C192		Same as C115	Relay B+ bypass
C193		Same as C118	Screen bypass, V106

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C194	— N16-C-18631-1534 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 mmf, GA (MRC) tolerance; 500 vdcw; standoff type; 11/16 in. lg (including 0.181 in. lg solder terminal and 5/16 in. lg 6-32 mtg thd); capacitor body hexagon shape; max dia 0.288 in. non-removable lockwasher; CSF #507C-1000; CADV #10665	RF bypass, T152 secondary
C195		Same as C115	B+ bypass, V107
C196		Same as C185	Tuning capacitor, T153 primary
C197		Same as C118	Cathode bias bypass, V107
C198		Same as C115	Cathode bias bypass, V107
C199		Same as C115	Heater bypass, V107
C200		Same as C115	AGC bypass, V108
C201		Same as C118	RF bypass, T153 primary
C202		Same as C118	Relay B+ bypass
C203		Not used	
C204		Not used	
C205		Same as C194	RF bypass, T153 secondary
C206		Same as C118	Screen bypass, V107
C207		Not used	
C208		Same as C191	AGC bypass, V108
C209		Same as C118	Cathode bias bypass, V108
C210		Same as C115	Cathode bias bypass, V108
C211		Same as C115	Heater bypass, V108
C212		Same as C185	Tuning capacitor, T154 primary
C213		Same as C115	B+ bypass, V108
C214		Same as C118	RF bypass, T154 primary
C215		Same as C118	Screen bypass, V108
C216		Not used	
C217		Same as C115	B+ bypass, V109

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C218		Same as C185	Tuning capacitor, T155 primary
C219		Not used	
C220		Not used	
C221		Same as C115	Cathode bias bypass, V109
C222		Same as C118	Cathode bias bypass, V109
C223		Same as C118	B+ bypass, V109
C224		Same as C115	Heater bypass, V109
C225		Same as C118	RF bypass, T155 primary
C226		Same as C118	Screen bypass, V109
C227		Not used	
C228		Same as C115	B+ bypass, V109
C229		Same as C115	Heater bypass, V109
C230		Same as C118	Heater bypass, V109
C231		Same as C118	Cathode bypass, V110
C232		Same as C115	B+ bypass, V110
C233		Same as C115	Heater bypass, V110
C234		Same as C118	Bucking bias bypass, V111
C235		Same as C115	Bucking bias bypass, V111
C236		Not used	
C237		Same as C191	V110 neutralizing capacitor
C238		Same as C191	Screen coupling, V110
C239		Same as C185	Tuning capacitor, T156 primary
C240		Same as C118	B+ bypass, V110
C241		Same as C194	RF bypass, T156 secondary
C242		Not used	

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C243		Same as C115	AGC bypass, V111
C244		Same as C115	AGC bypass, V111
C245		Not used	
C246	— N16-C-15925-5101 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: feedthru type; 10 mmf + 10%; 1000 vdcw; 5/8 in. lg by 5/16 in. hex; silicone-enameled finished ends; two axial soft wire leads max length each 1-5/16 in.; body of capacitor threaded for 12-28 nut; CER #362-03; CADV #10389	RF bypass, V111
C247		Same as C191	Plate coupling, V112
C248		Same as C118	RF bypass, V111
C249		Same as C115	RF bypass, V111
C250	— N16-C-455773-6255 —	CAPACITOR, FIXED, PAPER DIELECTRIC: 100,000 mmf 10%; 400 vdcw; two radial wire leads one end of capacitor, both insulated from case; hermetically sealed metal case 1-1/16 in. lg by 13/32 in. dia; mtg bracket on lead end; bracket has 0.136 in. hole for 4-40 mtg screw; CSF #10899-42054; CADV #10669	FI and QP weighting circuit, V111
C251		Not used	
C252		Same as C118	B+ bypass, V112
C253		Same as C115	B+ bypass, V112
C254		Same as C246	RF bypass, V111
C255		Same as C115	RF bypass, V111
C256		Not used	
C257		Not used	
C258		Not used	
C259	3DA50-474 N16-C-44281-8250 —	CAPACITOR, FIXED, PAPER DIELECTRIC: 50,000 mmf, -10% +20%; 200 vdcw; hermetically sealed metal case; vinylite covering; wax impregnated; two axial wire leads, one common to metal case, one insulated; lead length 2-1/2 in. max; max case dim. 3/4 in. lg by 3/8 in. dia; "Stoddart", value and working voltage marked on case; CAMD-ME; CADV #10196	Audio coupling to V113
C260		Same as C118	Screen bypass, V113
C261	— ***N16-C-44111-2680	CAPACITOR, FIXED, PAPER DIELECTRIC: 47,000 mmf ± 20%; 300 vdcw; hermetically sealed metal case with vinylite covering; wax impregnated; two axial wire leads max length 2-1/4 in., one common to case; case dim. 13/16 in. lg by 0.40 in. dia; Westcap #13M3473; CADV #10670	Compensating, V113

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C262		Same as C245	Audio coupling to V114
C263		Same as C118	Video coupling to J107
C264	— N16-C-19458-8421 —	CAPACITOR, FIXED, ELECTROLYTIC: tantalum; 5.0 mfd - 15% + 50%; 50 vdcw; 31/64 in. lg by 7/32 in. max dia; mts by two axial wire leads 1-1/2 in. lg; marked with mfr part no. and capacitor polarity; CATD #PP5B50A2; CADV #10677	Cathode bypass, V114
C265		Same as C259	RF bypass, J108
C266		Same as C259	Audio coupling to V115
C267	— ***N16-C-45803-1984 —	CAPACITOR, FIXED, PAPER DIELECTRIC: 100,000 mmf ± 20%; 200 vdcw; hermetically sealed metal case 7/8 in. lg by 5/16 in. dia; two axial wire leads 1-7/8 in. lg; insulated from case; vinylite case covering; Westcap #12M2104; CADV #10678	Cathode bypass, V115
C268		Same as C118	Screen bypass, V115
C269		Same as C118	RF bypass, T157 primary
C270		Same as C118	RF bypass, V116
C271		Same as C191	Audio coupling to V116
C272		Same as C118	Plate coupling, V116
C273		Same as C118	Plate coupling, V116
C274		Same as C118	Audio coupling to V117
C275		Same as C118	Cathode bypass, V117
C276		Same as C118	Screen bypass, V117
C277		Same as C118	RF bypass, J110
C278		Same as C118	RF bypass, J111
C279		Not used	
C280		Not used	
C281	— N16-C-17919-2388 —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: tubular; 330 mmf tolerance ± 20% at + 85°C; 500 vdcw; molded phenolic insulation; 0.562 in. lg by 0.250 in. dia max dim.; CER#GP2K-331; CADV #10667-331	Heater voltage coupling, V121

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
C282		Not used	
C283		Same as C118	RF bypass, Z107
C284		Same as C245	Audio bypass, V121
C285		Same as C118	Plate coupling, V121
C286		Same as C118	Plate coupling, V121
C287		Same as C118	Audio bypass, V121
C288		Not used	
C289		Same as C118	Audio bypass, R230
C290		Same as C118	Audio coupling, S102
C291		Same as C191	Rectifier bypass, CR101
CR101	2J1N63 N16-T-51763 —	CRYSTAL UNIT, RECTIFYING: germanium diode; type 1N63; 1/2 in. lg by 0.220 in. max dia; mounts by two axial wire leads 1 in. lg; CG #1N63; CADV #10679	Pulse stretcher diode, S102
E101	*	TUBE SHIELD ASSEMBLY: sub-miniature; beryllium copper, silver plated; 1-1/2 in. lg by 1 in. w by 27/64 in. h; CADV #90830-1	V101, V102 shield
E102		Same as E101	V103, V104 shield
E103	*	TUBE SHIELD ASSEMBLY: sub-miniature; beryllium copper, silver plated, 1-1/2 in. lg by 1 in. w by 27/64 in. h; CADV #90829-1	V105 shield
E106	2Z8304.227 N16-S-34557-8351 —	SHIELD, TUBE: brass nickel plated; tubular; open top; bayonet type mtg; 0.810 in. ID by 0.941 OD by 1-3/4 in. lg; internal tension spring for retaining tube in socket; JAN-S-28A; JAN TS102U02; CER SOS-6; CADV #10116	V106 shield
E107		Same as E106	V107 shield
E108		Same as E106	V108 shield
E109		Same as E106	V109 shield
E110	2Z8304.227 N16-S-34607-6039 —	SHIELD, TUBE: brass nickel plated; 2-1/4 in. lg by 0.810 in. ID by 0.941 OD; internal tension spring for retaining tube in socket; tubular open top; bayonet type mtg; for 7-pin miniature socket; JAN S-28A spec; JAN TS102U03; CADV #10039	V110 shield
E111	2Z8304.57 N16-S-34520-3862 —	SHIELD, TUBE: JAN type TSFOT101; brass nickel plated; tubular open top cylindrical twist-on mtg slots for attaching to JAN style #10 and #11 tube sockets; 1/2 in. ID by 1-3/8 in. lg by 0.941 in. OD; internal tension spring for retaining tube in socket; spec JAN S-28A; CED #SOS-3; CADV #10113	V111 shield

* Shop manufacture

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
E112		Same as E106	V112 shield
E113		Same as E106	V113 shield
E114		Same as E106	V114 shield
E115		Same as E106	V115 shield
E116	2Z8304.275 N16-S-34576-6513 —	SHIELD, TUBE: brass nickel plated; tubular, open top; bayonet type mtg; 1-15/16 in. lg by 1.05 in. OD by 0.950 in. ID; internal tension spring for retaining in socket; spec JAN S-28A; CMG #TSFOT105; CADV #10410	V116 shield
E117		Same as E106	V117 shield
E118	+	KNOB, TUNING CRANK ASSEMBLY: consists of tuning crank, knob and stud; overall dim. 25/32 in. deep by 1-1/16 in. OD; tuning crank and stud 17S-T4 aluminum; black anodized; knob black phenolic grade XR; engraved with letter H, 3/16 in. h, white filled; CADV #20427-1	Tuning knob
E119		Same as E106	V119 shield
E120		Same as E106	V120 shield
E121		Same as E116	V121 shield
E122		Same as E110	V122 shield
E123	— N16-K-700362-0207 —	KNOB: round fluted; black phenolic; for 1/4 in. dia shaft; double 10-32 set screw, 90° apart; white filled indicator dot and letter A, 3/16 in. h, white filled; 1-5/8 in. dia by 3/4 in. h overall; brass insert; depth of shaft hole 1/2 in.; CAUP-S-309-64-DL-522; CADV #20424-1	Attenuator knob
E124		Not used	
E125		Not used	
E126		Not used	
E127		Not used	
E128	2Z3350-123 N17-C-200964-601 —	CAP, CONNECTOR: AN type CW-123/U; for UG-290/U; max dim., 11/16 in. lg by 9/16 in. dia; has internal neoprene seal; chain with screw eye 2-1/4 in. lg, brass nickel plated; cap, brass, silver plated; CARO-LPC-1500; CADV #10261	Cover for J107
E129	+	KNOB: bar, black phenolic; for 1/4 in. dia shaft; double 6-32 set screw 90° apart; white filled arrow marking and engraved letter B, 3/16 in. h; 1-1/8 in. lg by 11/16 in. w overall; brass insert; depth for shaft hole 1/2 in.; DMC-46A41091; CADV #20426-1	Function switch knob
E130	+	KNOB: round; type BMD-5000 black 2.5; for 1/4 in. dia shaft; double 6-32 set screw, 90° apart; engraved letter F, 3/16 in. h, white filled; 1 in. dia by 1/2 in. h overall; shaft hole 13/32 in. d; fine straight knurl; CADV #20425-4	Audio control knob

+ Low failure item - if required requisition from ESO referencing NAVSHIPS 900,180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)	
E131	+	KNOB: bar, black phenolic; for 1/4 in. dia shaft; double 6-32 set screw 90° apart; engraved letter G, white filled, 3/16 in. h; 1-1/4 in. lg by 3/4 in. w max dim.; depth of shaft hole 1/2 in.; CADV #20423-1	Bandswitch knob
E132	+	KNOB: round; type BM-8052; red; for 1/4 in. dia shaft; double 6-32 set screw; 90° apart; engraved letter D, white filled, 3/16 in. h; 1 in. dia by 1/2 in. overall; shaft hole 13/32 in. d; fine straight knurl; CADV #20425-3	Calibrate knob
E133	+	KNOB: round; type BM-15169; green; for 1/4 in. dia shaft; double 6-32 set screw; 90° apart; engraved letter C, 3/16 in. h, white filled; 1 in. dia by 1/2 in. h overall; shaft hole 13/32 in. deep; fine straight knurl; CADV #20425-1	Peak knob
E134	+	KNOB: round; type BM-15169; green; for 1/4 in. dia shaft; double 6-32 set screw; 90° apart; engraved letter E, 3/16 in. h, white filled; 1 in. dia by 1/2 in. h overall; shaft hole 13/32 in. d; fine straight knurl; CADV #20425-2	Peak sensitivity knob
E135		Not used	
E136	— N16-A-22081-1047 —	NETWORK, IMPEDANCE MATCHING: consists of single tubular film type fixed resistor (50 ohms) mtd at middle of coaxial tube, with metal taper for impedance match; used for terminating 50 ohm coaxial line; 9/16 in. OD by 3 in. lg overall; has special 50 ohm rf connector on each end; p/o CADV #90802-1; CADV #90831-1	Used in calibrate position
E137	— N16-T-25301-1231 —	TRANSMISSION LINE SECTION: rf transmission; 9/16 in. OD by 3 in. lg overall; has special 50 ohm rf connector on each end; p/o CADV #90802-1; CADV #90388-1	X1 attenuator position
E138		Same as E137	X10 attenuator position
E139	2Z394.164 N16-A-97144-7001 —	RESISTOR ASSEMBLY, FIXED: consists of T section attenuator using two series tubular film type resistors 40.91 ohms ea and one shunt film resistor (disc) 10.0 ohms; mtd in coaxial tube with metal tapers for impedance match; attenuates 20 db; 9/16 in. OD by 3 in. lg overall; has special 50 ohm rf connector on ea end; p/o CADV #90802-1; CADV #90389-1	$X10^2$ attenuator position
E140	2Z394.170 N16-A-97192-1001 —	RESISTOR ASSEMBLY, FIXED: consists of T section attenuator using two series tubular film type resistors 49.01 ohms ea and one shunt film resistor (disc) 1.0 ohms; mtd in coaxial tube with metal tapers for impedance match; attenuates 40 db; 9/16 in. OD by 3 in. lg overall; has special 50 ohm rf connector ea end; p/o CADV #90802-1; CADV #90389-2	$X10^3$ attenuator position
E141	2Z394.171 N16-A-97197-1001 —	RESISTOR ASSEMBLY, FIXED: consists of T section attenuator using two series tubular film type resistors 49.9 ohms ea and one shunt film resistor (disc) 0.1000 ohms; mtd in coaxial tube with metal tapers for impedance match; attenuates 60 db; 9/16 in. OD by 3 in. lg overall; has special 50 ohm rf connector ea end; p/o CADV #90902-1; CADV #90389-3	$X10^4$ attenuator position
E142		Not used	

+ Low failure item - if required requisition from ESO referencing NAVSHIPS 900, 180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
E143	— N17-S-250051-0383 —	SHELL, CONNECTOR, JUNCTION: for P104; Cannon type DB; for use with DB-25 connector; steel, gold plated; 2-1/2 in. lg by 0.431 in. thk by 41/64 in. h; 0.875 in. wire opening; CED-DB; CADV #10612	Shell for P104
E144	— N17-S-250051-0385 —	SHELL, CONNECTOR, JUNCTION: 3/4 in. lg by 15/32 in. max dia; 5/32 in. wire opening; molded melamine; Winchester Electronics #H-10; CADV #10615	Hood for P109
H101 thru H108		Not used	
H109	+	WRENCH, TUNING: CZR #68-21; CADV #50625	RF head tuning tool
H110	2Z3351-449 N17-G-945001-850 —	COVER, TELEPHONE JACK: cold-rolled steel; satin chrome finish; 1-1/32 in. lg by 13/16 in. w by 17/32 in. thk; mts by 0.386 in. dia hole with single locknut; cover contains neoprene pad; opens 90°; for plugs to 5/8 in. body dia; spring loaded cap; CAHW-A-23559; CADV #10311	Remote meter jack cover
H111		Same as H110	Recorder jack cover
H112		Same as H110	Telephone jack cover
H113	*	GASKET: shaft seal; 0.170 in. ID; silicone rubber, modified CAOR-H-1268; #20314-1	Tuning shaft seal
H114	*	GASKET: shaft seal; 0.230 in. ID; silicone rubber, modified CAOR-H-1268; CADV #20314-2	Attenuator shaft seal
H115		Same as H114	Audio shaft seal
H116		Same as H114	Function switch shaft seal
H117		Same as H114	Bandswitch shaft seal
H118	*	GASKET: shaft seal; 0.250 in. ID; silicone rubber; modified CAOR-H-1268; CADV #20314-3	Peak sensitivity shaft seal
H119		Same as H118	Calibrate shaft seal
H120		Same as H118	Peak shaft seal
H121	+	NUT, SEAL: 3/8-32; has flange for shaft seal gasket; CAOR #HA-1262; CADV #70163	Peak sensitivity shaft seal
H122		Same as H121	Gasket
H123		Same as H121	Calibrate control gasket
H124		Same as H121	Peak control gasket
H125		Same as H121	Audio control gasket

* Shop Manufacture + Low failure item - if required requisition from ESO referencing NAVSHIPS 900. 180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)	
H126	2Z4868.1161 N17-G-153893-186 —	GASKET, RECEPTACLE: shoulder cover; neoprene; 5 holes; square; 1 in. by 1 in. by 0.031 in. thk; CADV #20142	Antenna receptacle gasket
H127	2Z4868.1160 N17-G-153812-881 —	GASKET, RECEPTACLE: shoulder cover; neoprene; 5 holes; square; 11/16 in. by 11/16 in. by 0.031 in. thk; CADV #20143	Oscilloscope jack gasket
H128	2Z4868.1162 N17-G-153987-882 —	GASKET, CONNECTOR: shoulder cover; neoprene; 5 holes; square; 1-3/16 in. by 1-3/16 in. by 1/32 in. thk; CADV #20063	Power receptacle gasket
H129	— +++ —	GASKET: neoprene rod; 3/32 in. dia by 28 in. lg; CADV #20285	Instrument case gasket
H130	— N33-G-12575-0710 —	GASKET: "O" ring, neoprene; CAOR-HA1264; CADV #70164	Used with H121
H131		Same as H130	Used with H122
H132		Same as H130	Used with H123
H133		Same as H130	Used with H124
H134		Same as H130	Used with H125
H135	— GM41-W-02445-0002 —	WRENCH, ALLEN: for #6 Allen set screw; 1-3/4 in. lg by 9/16 in.; 1/16 in. across flats; solid six point hex; CAYT #6; CADV #70131	Set screw wrench
H136	— GM41-W-02446-0002	WRENCH, ALLEN: for #8 Allen set screw; 2 in. lg by 11/16 in. dia; 0.0775 in. across flats; solid six point hex; CAYT #8; CADV #70058	Set screw wrench
H137	— GM41-W-02449-0002 —	WRENCH, ALLEN: for #10 Allen set screw; 2-1/16 in. lg by 3/4 in.; 1/16 in. across flats; solid six point hex; CAYT #10; CADV #70242	Set screw wrench
H138	— G17-E-850271-0101 —	EXTRACTOR, ELECTRON TUBE: rubber; one half cylindrical in shape, the other half conical in shape; overall dim. 3 in. lg by 13/16 in. OD one end by 1/2 in. OD other end; CAYZ #L-73; CADV #20466	For removal and replacement of subminiature tubes
I101	— GM17-L-06811-0025 —	LAMP, INCANDESCENT: Sig C LM-52; Navy type TB-14; 6-8 volts; 0.15 amp; bulb T-3-1/4 clear; 1-3/16 in. lg overall; miniature bayonet base; C2 filament; burn any position; CG #GE-47; CADV #10051	Tuning dial illumination
I102	2Z5889-3 GM17-L-06811-0025 —	LAMP, GLOW: indicator type; Navy type VG-12; CG #NE-48; CADV #10726	Visual null indicator
J101		CONNECTOR, RECEPTACLE: one round female contact; coaxial; straight type; 5/8 in. dia; part of Z114 isolating capacitor assembly (LISTED FOR REFERENCE ONLY-SEE Z114)	RF INPUT receptacle

+++ Fabricate locally from bulk material, SNSN. . . . . .

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
J102	— N17-C-67444-2001 —	CONNECTOR, ADAPTER: right angle; male one end; female other end; 1-15/64 in. h by 3/8 in. w by 11/16 in. dia; basic internal construction identical to UG-27A/U; one end threaded 5/8-24 thread; cylindrical brass body, silver plated; p/o Z113; CANS #KN-9901; CADV #10661	Attenuator input
J103	— N17-C-73630-9045 —	CONNECTOR, PLUG: male; 25 contacts, copper base alloy; gold plated contacts; DuPont molded nylon FM-10001 insulating material; 2-5/64 in. lg by 31/64 in. w by 27/64 in. thk; CED #DB-25; CADV #10732	IF chassis power connector
J104		CONNECTOR, RECEPTACLE: one round female contact; coaxial; straight type; 5/8 in. dia; part of Z114 isolating capacitor assembly (LISTED FOR REFERENCE ONLY - SEE Z114)	Connects attenuator input cable to Z114 isolating capacitor assembly
J105	— ***N17-C-73108-1267 —	CONNECTOR, RECEPTACLE: similar to Army-Navy Receptacle UG-290/U; one round male contact; straight type; 11/16 in. by 11/16 in. square by 1-1/16 in. lg overall; 500 volts peak; non-constant impedance; cyclindrical brass body; silver-plated; square mtg plate 0.90 in. thk with four #3-56 tapped holes; weatherproof; same as J107 except flange is chamfered; CARO-UG-290/U modified; CADV #10616	IF input
J106	2Z3025-51 N17-C-73501-3590 —	CONNECTOR, RECEPTACLE: Navy type (-491942); 5 round male contacts; polarized straight; 7/8 in. OD by 1-1/4 in. lg less plug prong; cyclindrical aluminum body; clear lacquer finish; molded synthetic rubber insert; four 0.120 in. dia mtg holes 29/32 in. between mtg.centers; 7/8-20 NEF-2 thread; electrostatic shielding between receptacle and matching plug is sphere and cone type; CED #02AR-14S-5P; CADV #10188	Power receptacle
J107	2Z7390-290 N17-C-73108-1267 —	CONNECTOR, RECEPTACLE: Army-Navy Receptacle UG-290/U; one round male contact; straight type; 11/16 in. by 11/16 in. square by 1-1/16 in. lg overall; 500 volts peak; non-constant impedance; cylindrical brass body; silver-plated; square mtg plate 0.90 in. thk with four #3-56 tapped holes; weatherproof; CARO #2700; CADV #10121	Oscilloscope output
J108	2Z5534 N17-J-39248-4418 —	JACK, TELEPHONE: Navy type no. (-49025A); for two conductor plug; 0.25 in. dia by 1-3/16 in. lg by 1 in. by 3/4 in. h; J1 contact arrangement; mtg bushing 3/8 in. -32 thread by 9/32 in. lg with hex mtg nut; 3/8 in. mtg hole; CMA JK-34A; CADV #10122	Headphone jack
J109	— N17-C-71479-5767 —	CONNECTOR, POWER: male; 4 gold-plated contacts; phosphor bronze; has lock ring and ground lug; molded melamine body; overall length 19/32 in.; hexagon shape, max width 15/32 in.; breakdown voltage 2500 vdc; Winchester Electronics M4P-LRN special (S molding); CADV #10613	RF power connector
J110	2Z5598-54 N17-J-39449-4770 —	JACK, TELEPHONE: Navy type (-491957); for three conductor plug; accommodates PL-68; 1-3/16 in. lg by 3/4 in. dia overall; 3/8 in. mtg hole; CBIM2J-1047A; CADV #10123	Remote meter jack
J111		Same as J110	Recording meter jack

*** For replacement (modified)

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
J112		CONNECTOR, RECEPTACLE: one round female contact; coaxial type 'N'; straight type; 5/8 in. dia; part of switch S101; (LISTED FOR REFERENCE ONLY - SEE S101)	RF output connector at S101
J113		CONNECTOR, RECEPTACLE: one round female contact; coaxial type 'N'; straight type; 5/8 in. dia; part of switch S101; (LISTED FOR REFERENCE ONLY - SEE S101)	Impulse noise calibrator input connector at S101
J114	— N17-C-73108-7477 —	CONNECTOR, PLUG: Army-Navy type UG-625/U; CADV #10727	Terminal connector for low pass filter
J115		Same as J114	Terminal connector for low pass filter
K101	— N16-R-71345-8401 —	RELAY: double pole, double throw; dc; 30 volts, 3 amps; one coil winding; dc winding resistance 4700 ohms; operating voltage 38.6 to 42.0 vdc at 23°C; continuous duty; hermetically sealed; 15/16 in. sq by 1-3/32 in. max less mtg studs and terminals; mounts by two 4-40 threaded studs each 1/4 in. lg; eight "J" shaped wire terminals fixed circularly in glass bead-type insulators in sealed base; 50 "G" shock test; operating temperature range - 55°C to + 85°C; CJN #IR-207-38; CADV #10618	Introduces 20 db attenuation at first IF
L101	— + —	CHOKE: RF: filament, 21 turns #25 Formvar, 3/32 in. ID by 1/2 in. lg; CADV #10617	Filament choke, V101, V102
L102		Same as L101	Filament choke, V103, V104
L103		Same as L101	Filament choke, V105
L104	— N16-C-73088-9362 —	CHOKE, RF: 10 microhenries at 7.9 mc test frequency; single pi universal wound; unshielded; dc resistance 2.25 ohms; 7/32 in. OD by 3/64 in. w; phenolic form; 11/32 in. lg by 1/8 in. OD; pigtail leads 1-17/32 in; wax impregnated; CADV #10360	RF choke, T156 secondary
L105		Same as L104	RF choke, V111 output
L106	— N16-C-69001-1027 —	CHOKE, RF: 120 microhenries; solenoid type; iron core; 25/32 in. lg by 9/32 in. dia; two axial wire leads 1-5/16 in. lg; CAUZ #10404-36; CADV #10692	RF choke, V111 output
L107	— N16-C-75280-8657 —	CHOKE, RF: 19 millihenries; single pi universal wound; unshielded; CADV #90825-1	RF choke at audio output
M101	— N17-M-29352-9643 —	METER, MULTI-SCALE: dc; 0-1 ma; fan-shaped steel case 4-7/16 in. h by 5-5/8 in. w by 1-13/32 in. d; ± 1% accuracy for full scale reading; 1450 ohms ± 10% internal resistance; calibrated for non-magnetic panel; high speed response; black printing on white background; 26 divisions on 0-100 microvolt scale; 40 divisions for 0.40 db scale; lance type pointer; mts by two binding post terminals 3/8-24 thread, 11/16 in. lg; CV #269; CADV #10702	Microvolt and db meter

+ Low failure item - if required requisition from ESO referencing NAVSHIPS 900, 180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-98/URM-47 (Cont'd)			
N101	6D10105A — —	CHART SET: Army-Navy Chart Set PT-188/URM-47; calibration; not calibrated; vinylite 8-1/2 in. lg by 5-1/2 in. w by 0.015 in. thk; black printing on white background; plastic ring binder; CADV #91036-1; (LISTED FOR REFERENCE ONLY)	Calibration chart set
O101	*	DETENT-SHAFT-GEAR RIVET ASSEMBLY: CADV #90870-1	Bandswitch detent
O102	— N16-G-433295-0731 —	DRIVE GEAR ASSEMBLY: CADV #90890-1	Bandswitch and tuning gear
O103		Same as O102	Bandswitch and tuning gear
O104		Same as O102	Bandswitch and tuning gear
O105		Same as O102	Bandswitch and tuning gear
O106		Same as O102	Bandswitch and tuning gear
O107		Same as O102	Bandswitch and tuning gear
O108		Same as O102	Bandswitch and tuning gear
O109	+	DRIVE GEAR: CADV #50507	Bandswitch and tuning gear
O110		Same as O109	Bandswitch and tuning gear
O111		Same as O109	Bandswitch and tuning gear
O112		Same as O109	Bandswitch and tuning gear
O113		Same as O109	Bandswitch and tuning gear
O114		Same as O109	Bandswitch and tuning gear
O115		Same as O109	Bandswitch and tuning gear
O116	*	BANDSWITCH CONTROL SHAFT ASSEMBLY: CADV #90891-1	Bandswitch control
O117	*	DIAL ASSEMBLY: CADV #90892-1	Frequency dial
O118	*	COUNTER SHAFT-FRICTION DISC ASSEMBLY: CADV #90893-1	
O119	2Z4872-516 — —	COUNTER SHAFT GEAR: CADV #50514	Tuning drive gear

* Shop Manufacture + Low failure item - if required requisition from ESO referencing NAVSHIPS 900, 180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
O120	*	IDLER GEAR: CADV #50515	Bandswitch idler gear
P101	— N17-C-71408-3168 —	CONNECTOR, PLUG: rf coaxial type; male; 1 contact; straight; 3/4 in. OD by 15/16 in. lg overall; cylindrical brass body, silver-plated; Type "N"; coupling nut; CADV #90399-1	Connects to rf attenuator
P102		Same as P101	Connects to S101 rf output, (p/o W103)
P103	2Z7390-260 N17-C-71408-5333 —	CONNECTOR, PLUG: Army-Navy type UG-88/U; CADV #10084	Connects to IF amplifier input
P104	— N17-C-73333-7541 —	CONNECTOR, RECEPTACLE: 25 contacts; copper base alloy, gold plated; DuPont molded nylon FM-10001 insulating material; 2-5/64 in. lg by 31/64 in. w by 27/64 in. thk; CED #DB-25; CADV #10683	IF chassis power connector
P105		Same as P101	Connects to coaxial switch, (p/o W102)
P106		Same as P101	Connects to output of attenuator pad E142, (p/o W102)
P107		Same as P103	Connects W103 to Z115
P109	— N17-C-73184-9201 —	CONNECTOR, RECEPTACLE: 4 contacts, phosphor bronze gold plated; has lock ring and ground lug; molded melamine body; overall length, including terminal lugs, 19/32 in.; hex shape; max width 19/32 in.; breakdown voltage 2500 vdc; Winchester Electronics #M4S-LRN; CADV #10614	RF head power input
P110		Same as P101	Connects Z114 to attenuator input
R101	3RC20BF393J N16-R-50443-0431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF393J; 39,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3935; CADV #10011-393	Screen dropping, V101
R102	— N16-R-55132-0261 —	RESISTOR, FIXED, COMPOSITION: 100,000 ohms; ±10%; 1/5 watt; 1/4 in. lg by 1/16 in. dia; uninsulated; two radial wire lead terminations; CCO #997A-104; CADV #10693-104	Grid bias decoupling, V101, V102
R103	— N16-R-55213-0121	RESISTOR, FIXED, COMPOSITION: 220,000 ohms; ±5%; 1/5 watt; 1/4 in. lg by 1/16 in. dia; uninsulated; two radial wire lead terminations; CCO #997A-224; CADV #10693-224	Grid bias decoupling, V101
R104		Same as R103	Grid bias decoupling, V102
R105		Same as R101	Screen dropping, V102
R106	3RC20BF272J N16-R-50038-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF272J; 2700 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-2725; CADV #10011-272	Plate dropping, V101, V102

* Shop Manufacture

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R107	3RC20BF222J N16-R-50011-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF222J; 2200 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-2225; CADV #10011-222	Plate dropping, V101, V102
R108	3RC20BF152J N16-R-49966-431 —	RESISTOR, FIXED, CAPACITOR: JAN RC20BF152J; 1500 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1525; CADV #10011-152	Voltage divider, V101, V102 grid bias
R109	3RC20BF104J N16-R-50632-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF104J; 100,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1045; CADV #10011-104	Voltage divider, V101, V102 grid bias
R110		Not used	
R111		Same as R103	Grid return, V103
R112		Same as R103	Grid return, V104
R113	3RC20BF684J N16-R-50893-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF684J; 680,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-6845; CADV #10011-684	Screen dropping, V103
R114		Same as R113	Screen dropping, V104
R115	3RC20BF102J N16-R-49921-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF102J; 1000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1025; CADV #10011-102	Decoupling, V105 (B+)
R116	3RC20BF101J N16-R-49579-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF101J; 100 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1015; CADV #10011-101	Isolating resistor, Z215
R117		Same as R116	Isolating resistor, Z216
R118		Same as R116	Isolating resistor, Z235
R119		Same as R116	Isolating resistor, Z236
R120	3RC20BF103J N16-R-50281-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF103J; 10,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1035; CADV #10011-103	Grid bias, V106
R121	— N16-R-64111-9651 —	RESISTOR, FIXED, WIREWOUND: 1500 ohms; 25 watts; ± 5%; 1-16 in. lg less terminal lugs; lugs 7/16 in. lg; one located axially ea end; die cast black anodized radiator-finned housing 1/2 in. dia mtg lugs 9/32 in. extended ea side; mts by two #6 screws; Dale Products Co., Inc. #RH-25-1500;CADV #10705-152	Dropping resistor at V122
R122		Not used	
R123	— — —	RESISTOR, FIXED, COMPOSITION: 33 ohms; ± 5%; 1/4 watt; 1/4 in. lg by 1/16 in. dia; two radial wire lead terminations; CCO #997A-330; CADV #10693-330	Cathode load at V105

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R124	3RC20BF392J N16-R-50092-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF392J; 3900 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3925; CADV #10011-392	Grid bias at V105
R125	3RC20BF563J N16-R-50515-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF563J; 56,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-5635; CADV #10011-563	Plate dropping resistor at V103, V104
R126	3RC20BF151J N16-R-49624-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF151J; 150 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1515; CADV #10011-151	Cathode bias, V106
R127	3RC30BF184J N16-R-50695-751 —	RESISTOR, FIXED, COMPOSITION: JAN RC30BF184J; 180,000 ohms; ± 5%; 1 watt; spec JAN-R-11; CBZ #GB-1845; CADV #10012-184	Voltage divider, CAL control
R128	— N16-R-87679-4180 —	RESISTOR, VARIABLE COMPOSITION: 10,000 ohms; ± 10%; 2 watts; 100°C max continuous operation; 3 lug terminals; 1-1/16 in. dia by 9/16 in. d; enclosed body; shaft 1/4 in. dia by 3/4 in. from mtg surface; plain round U taper; insulated contact arm; normal torque; bushing 3/8-32 by 1/4 in. lg; CBZ J U-1031; CADV #10408	CAL control
R129	3RC20BF332J N16-R-50065-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF332J; 3300 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3325; CADV #10011-332	AGC decoupling, T152 secondary
R130		Same as R127	Screen dropping resistor at V106
R131		Same as R116	B+ decoupling, V106
R132		Same as R126	Cathode bias at V107
R133		Same as R129	AGC decoupling, T153 secondary
R134	3RC20BF683J N16-R-50551-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF683J; 68,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-6835; CADV #10011-683	Screen dropping at V107
R135		Same as R116	B+ decoupling, V107
R136		Same as R126	Cathode bias at V108
R137	— N16-R-87521-8061 —	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms; locking type; ± 20%; 1/2 watt; 100°C max continuous operation; 3 solder lug terms; enclosed molded phenolic case 0.840 in. dia by 0.280 in. d; insulated contact arm; normal torque; lock-bushing; CBZ #TSLU5022; CADV #10694	FI-10 control
R138	3Z6610-392 N16-R-64155-1034 —	RESISTOR, FIXED, WIREWOUND: 10,000 ohms; 25 watts; ± 5%; 1-1/16 in. lg less terminal lugs; lugs 7/16 in. lg; one located axially ea end; die cast black anodized radiator-finned housing 1/2 in. dia, mtg lugs 9/32 in. extended ea side; mts by two #6 screws; Dale Products Co., Inc. #RH-25-10000; CADV #10705-103	Relay voltage dropping resistor

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R139 thru R141		Not used	
R142	3RC30BF124J N16-R-50650-751 —	RESISTOR, FIXED, COMPOSITION: JAN RC30BF124J; 120,000 ohms; ± 5%; 1 watt; spec JAN-R-11; CBZ-EB-1245; CADV #10012-124	Voltage divider with FI-10 control
R143		Same as R134	Screen dropping, V108
R144		Same as R116	B+ decoupling, V108
R145		Same as R126	
R146	3RC20BF271J N16-R-49687-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF271J; 270 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-2715; CADV #10011-271	B+ decoupling, V109
R147	3RC20BF473J N16-R-50479-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF473J; 47,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-4735; CADV #10011-473	Screen dropping, V109
R148		Not used	
R149	3RC20BF561J N16-R-49804-431 —	RESISTOR FIXED, COMPOSITION: JAN RC20BF561J; 560 ohms; ±5%; 1/2 watt; spec JAN-R-11;CBZ-EB-5615; CADV #10011-561	Cathode bias, V110
R150	3RC20BF273J N16-R-50398-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF273J; 27,000 ohms; ±5%; 1/2 watt; spec JAN-R-11; CBZ-EB-2735; CADV #10011-273	Screen dropping V110
R151		Same as R115	B+ decoupling, T156 primary
R152		Same as R108	B+ dropping resistor for dynamic range adjust
R153	3Z7410-209 N16-R-87679-4540 —	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms; ± 10%; 2 watts; 100°C max continuous operation; 3 solder lug terms.; enclosed molded phenolic case; 1-1/16 in. dia by 9/16 in d; slotted metal shaft 1/4 in. dia by 5/8 in. lg from mtg surface; U taper; insulated contact arm; normal torque; lock-bushing 3/8-32 by 1/2 in. lg; non-turn device located at 17/32 radius at 9 0'clock; CBZ type "J"; CADV #10252	Dynamic range adjust
R154 thru R160		Not used	
R161		Same as R125	Grid bias, V112
R162		Not used	
R163	3RC20BF565J N16-R-51208-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF565J; 5.6 megohms; ±5%; 1/2 watt; spec JAN-R-11; CBZ-EB-5655; CADV 310011-565	FI and QP weighting circuit, V111

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R164		Same as R150	Load resistor, V111
R165		Same as R109	Grid return, V115
R166	3RC20BF105J N16-R-50974-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF105J; 1.0 megohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1055; CADV #10011-105	Grid return, V113
R167 thru R176		Not used	
R177	3RC20BF181J N16-R-49642-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF181J; 180 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1815; CADV #10011-181	Cathode bias, V113
R178	3RC20BF121J N16-R-49597-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF121J; 120 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1215; CADV #10011-121	Cathode bias, V115
R179		Same as R150	Screen dropping, V113
R180	3RC30BF822J N16-R-50236-751 —	RESISTOR, FIXED, COMPOSITION: JAN RC30BF822J; 8200 ohms, ± 5%; 1 watt; spec JAN-R-11; CBZ-GB-8225; CADV #10012-822	Plate load, V113
R181		Same as R180	Plate load, V113
R182	— N16-R-87849-4248 —	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms; ± 10%; 2 watts max continuous rating; 3 solder lug terminals; metal enclosed case 1-1/16 in. dia by 9/16 in. d; round metal shaft 1/4 in. dia by 5/8 in. lg from mtg surface; linear (U) taper; no off position; normal torque; CBZ type "J"; CADV #10041	Audio control
R183	3RC20BF333J N16-R-50416-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF333J; 33,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3335, CADV #10011-333	Screen dropping, V115
R184	3RC20BF823J N16-R-50587-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF823J; 82,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-8235; CADV #10011-823	Voltage divider with peak sensitivity control
R185 thru R188		Not used	
R189	3RC20BF274J N16-R-50740-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF274J; 270,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11 CBZ-EB-2745; CADV #10011-274	Grid resistor, V116
R190	3RC20BF564J N16-R-50857-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF564J; 560,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-5645; CADV #10011-564	Grid return, V114

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)	
R191	— N16-R-87519-4226 —	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms; ± 10%; 2 watts; 100°C max continuous operation; 3 lug terminals; 1-1/16 in. dia by 9/16 in. d; enclosed body; shaft 1/4 in. dia by 3/4 in. from mtg surface; taper B; insulated contact arm; normal torque; bushing 3/8-32 by 1/4 in. lg; CBZ type "J"; CADV #10646	PEAK SENSITIVITY control
R192	3RC20BF153J N16-R-50335-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF153J; 15,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1535; CADV #10011-153	Volt divider with PEAK SENSITIVITY control
R193		Same as R125	Plate load, V116
R194		Same as R150	Plate load, V116
R195		Same as R115	Cathode bias, V114
R196	3RC20BF474J N16-R-50821-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF474J; 470,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-4745; CADV #10011-474	Grid bias, V116
R197		Same as R109	Grid bias, V116
R198		Same as R166	Integrating circuit resistor, V117
R199		Same as R150	Cathode bias, V116
R200		Same as R166	Grid return, V117
R201		Same as R116	Cathode bias, V117
R202		Same as R150	Screen dropping, V117
R203		Same as R166	J107 loading
R204	3RC30BF153 N16-R-50335-751 —	RESISTOR, FIXED, COMPOSITION: JAN RC30BF153J; 15,000 ohms; ± 5%; 1 watt; spec JAN-R-11; CBZ-GB-1535; CADV #10012-153	VTVM bias
R205	3RC20BF821J N16-R-49876-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF821J; 820 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-8215; CADV #10011-821	Cathode bias, V119
R206		Same as R205	Cathode bias, V120
R207		Same as R134	Plate load, V117
R208 thru R210		Not used	
R211	— N16-R-87751-8071 —	RESISTOR, VARIABLE, COMPOSITION: 1/2 watt; miniature type; 25,000 ohms; 0.840 in. dia by 0.280 in. case thk; overall height 0.530 in.; three radial wire leads; CBZ #TSLU2532; CADV #10685	FI-100 control

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R212		Same as R150	VTVM bridge
R213		Same as R153	ADJUST ZERO control
R214		Same as R150	VTVM bridge
R215		Same as R108	External meter compensating at J110
R216		Same as R108	External meter compensating at J111
R217 thru R220		Not used	
R221		Same as R116	B+ decoupling, Z107
R222	3RC20BF335 N16-R-51109-0431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF335; 3.3 megohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3355; CADV #10011-335	Grid bias, V121
R223		Same as R222	Grid bias, V121
R224	3RC20BF183J N16-R-50353-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF183J; 18,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1835; CADV #10011-183	Plate load, V121
R225		Same as R224	Plate load, V121
R226	3RC20BF681J N16-R-49840-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF681J; 680 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-6815; CADV #10011-681	B+ decoupling, V121
R227		Same as R115	C- decoupling, V121
R228		Same as R189	Voltage divider, S102
R229	3RC20BF244J N16-R-50722-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF244J; 240,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-2445; CADV #10011-244	Voltage divider, S102
R230		Same as R120	PEAK bias filter
R231		Same as R128	PEAK control
R232		Same as R134	Voltage divider with PEAK control
R233	3Z7310-143 N16-R-87351-8010 —	RESISTOR, VARIABLE, COMPOSITION: 1/2 watt miniature type; 1000 ohms; 0.840 in. dia by 0.280 in. case thk; overall height 0.530 in.; three radial wire leads; CBZ #TSLU1022; CADV #10686	QP-100 control
R234		Not used	

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
R235		Same as R137	FI BUCK control
R236		Same as R137	QP-1 control
R237		Same as R137	PEAK BUCK control
R238	— ***N16-R-50587-939 —	RESISTOR, FIXED, COMPOSITION: JAN RC40BF823J; 82,000 ohms; ± 5%; 2 watts; spec JAN-R-11; CBZ-HB-8235; CADV #10377-823	Voltage divider for "bucking" controls
R239		Same as R234	Cathode bias, V109
R240		Not used	
R241		Not used	
R242		Same as R109	Voltage divider, V117 grid bias
R243		Same as R120	Voltage divider, V117 grid bias
R244		Same as R204	Plate dropping, V112
R245	3RC20BF100J N16-R-49237-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF100J; 10 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1005; CADV #10011-100	I101 series
S101	— N16-T-25471-1014 —	SWITCH, COAXIAL: includes J112 and J113 which are integral and non-replaceable parts of this switch; 1-9/16 in. lg by 1-15/16 in. h by 49/64 in. thk; CADV #90801-1	Coaxial switch
S102	— N17-S-66623-6711 —	SWITCH, ROTARY: function; 5 sections; 5 positions; 30° throw; contacts and rotors solid silver; insulation 1/16 in. thk Bakelite; stainless steel index plate and detent spring; nickel plated brass bushing; front shaft rotates in conventional manner positions 1 through 5, rear shaft indexes one position ccw ea time front shaft rotates from position 2 to position 1; part number stamped on front plate; CADV #10482	Function switch
S103	— N16-S-69021-6601 —	SWITCH, SENSITIVE: single pole, single throw; 1-1/4 in. lg by 1/2 in. square not including terminals; terminal lugs 1/4 in. lg ea; CG "Switchette" #CR-1070-C130D3; CADV #10688	Attenuation relay switch
T101		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z201; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 1
T102		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z202; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 2
T103		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z203; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 3
T104		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z204; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 4
T105		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z205; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 5

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
T106		TRANSFORMER, RADIO FREQUENCY: antenna stage; p/o Z206; (LISTED FOR REFERENCE ONLY)	Antenna coil, band 6
T107		Not used	
T108		Not used	
T109		Not used	
T110		Not used	
T111		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; p/o Z211; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 1
T112		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; p/o Z212; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 2
T113		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; p/o Z213; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 3
T114		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; p/o Z214; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 4
T115		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit p/o Z215; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 5
T116		TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; p/o Z216; (LISTED FOR REFERENCE ONLY)	RF stage plate circuit, band 6
T117		Not used	
T118		Not used	
T119		Not used	
T120		Not used	
T121		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z221; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 1
T122		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z222; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 2
T123		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z223; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 3
T124		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z224; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 4
T125		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z225; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 5
T126		TRANSFORMER, RADIO FREQUENCY: mixer stage grid circuit; p/o Z226; (LISTED FOR REFERENCE ONLY)	Mixer stage grid coil, band 6
T127		Not used	
T128		Not used	
T129		Not used	

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
T130		Not used	
T131		TRANSFORMER, RADIO FREQUENCY: oscillator stage; band 1; p/o Z231; (LISTED FOR REFERENCE ONLY)	Oscillator coil, band 1
T132		TRANSFORMER, RADIO FREQUENCY: oscillator stage; band 2; p/o Z232; (LISTED FOR REFERENCE ONLY)	Oscillator coil, band 2
T133		TRANSFORMER, RADIO FREQUENCY: oscillator stage; band 3; p/o Z233;(LISTED FOR REFERENCE ONLY)	Oscillator coil, band 3
T134		TRANSFORMER, RADIO FREQUENCY: oscillator stage; band 4; p/o Z234; (LISTED FOR REFERENCE ONLY)	Oscillator coil, band 4
T135		TRANSFORMER, RADIO FREQUENCY: oscillator stage; band 5; p/o Z235; (LISTED FOR REFERENCE ONLY)	Oscillator coil, band 5
T136		TRANSFORMER, RADIO FREQUENCY: oscillator stage band 6; p/o Z236; (LISTED FOR REFERENCE ONLY)	Oscillator coil, band 6
T137 thru T149		Not used	
T150	— N17-T-82208-6164 —	TRANSFORMER, RADIO FREQUENCY: 15 mc approximate peak frequency; 2 windings; primary 31 turns #30 "Quicksol" single nylon covered wire; secondary 2 turns #30 "Quicksol" single nylon covered wire; both windings close solenoid; 1.520 in. lg by 9/16 in. w by 7/16 in. th; brass slug tuned; CADV #90837-1	Mixer output transformer
T151	— N17-T-67401-1056 —	TRANSFORMER, INTERMEDIATE FREQUENCY: 15 mc approximate peak frequency; input; unshielded; 1-5/16 in. max lg (with slug at max ccw position) by 19/32 in. dia; double tuned; brass slug tuning; CADV #90840-1	1st IF transformer
T152	— N17-T-67401-1064 —	TRANSFORMER, INTERMEDIATE FREQUENCY: 15 mc approximate peak frequency; interstage; unshielded; 1-5/16 in. max lg (with slug at max ccw position) by 19/32 in. dia; double tuned; brass slug tuning; CADV #90850-1	2nd IF transformer
T153		Same as T152	3rd IF transformer
T154	— N17-T-67401-1061 —	TRANSFORMER, INTERMEDIATE FREQUENCY: 15 mc approximate peak frequency; interstage; unshielded; 1-5/16 in. max lg (with slug at max ccw position) by 19/32 in. dia; double tuned; brass slug tuning; CADV #90948-1	4th IF transformer
T155	— N17-T-67401-1069 —	TRANSFORMER, INTERMEDIATE FREQUENCY: 15 mc approximate peak frequency; interstage; unshielded; 1-5/16 in. max lg (with slug at max ccw position) by 19/32 in. dia; double tuned; brass slug tuning; CADV #90982-1	5th IF transformer
T156	— N17-T-67401-1074 —	TRANSFORMER, INTERMEDIATE FREQUENCY: 15 mc approximate peak frequency; output; unshielded; 1-5/16 in. max lg (with slug at max ccw position) by 19/32 in. dia; double tuned; brass slug tuning; CADV #90860-1	IF output transformer

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
T157	2Z9632.680 N17-T-65498-4751 —	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; Navy type no. (-304878); primary 10,000 ohms impedance; primary 5 ma dc; 1-1/4 in. square by 1-3/4 in. lg; max audio level 100 milliwatts; turns ratio of primary to 1/2 secondary 3.75 to 1; frequency response 100 to 3000 cycles ± 2 db; electrostatic shield between primary and secondary; 4 solder lug terminals equidistantly spaced on bottom of transformer; mts by 2 - #6-32 by 1/4 in. dia inserts; CBGM #3875; CADV #10128	Pulse step-up transformer
T158		Same as T157	Audio output transformer
V101	2J5840 N16-T-75840 —	ELECTRON TUBE: JAN type 5840; CADV #5840	RF amplifier
V102		Same as V101	RF amplifier
V103		Same as V101	Mixer
V104		Same as V101	Mixer
V105	2J5718 N16-T-75718 —	ELECTRON TUBE: JAN type 5718; CADV #5718	Local oscillator
V106	2J6BH6 N16-T-56213-20 —	ELECTRON TUBE: JAN type 6BH6; CADV #6BH6	1st IF amplifier
V107		Same as V106	2nd IF amplifier
V108		Same as V106	3rd IF amplifier
V109		Same as V106	4th IF amplifier
V110	2J6005/6AQW N16-T-76005 —	ELECTRON TUBE: JAN type 6005; CADV #6005	5th IF amplifier
V111	2J5726/6AL5W N16-T-75726 —	ELECTRON TUBE: JAN type 5726; CADV #5726	Second detector
V112	2J6135 N16-T-76135 —	ELECTRON TUBE: JAN type 6135; CADV #6135	B F O
V113	— N16-T-56203-53 —	ELECTRON TUBE: JAN type 6AU6WA; CADV #6AU6WA	Video amplifier
V114		Same as V112	Audio output
V115		Same as V106	Pulse amplifier
V116	2J5814 N16-T-75814 —	ELECTRON TUBE: JAN type 5814; CADV #5814	Trigger circuit

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
V117		Same as V106	Pulse amplifier
V118		Not used	
V119		Same as V112	VTVM
V120		Same as V112	VTVM
V121		Same as V116	Multi-vibrator circuit
V122	2JOA2 N16-T-52001 —	ELECTRON TUBE: JAN type 0A2WA; CADV #0A2WA	Voltage regulator
W101	++	CABLE ASSEMBLY, RADIO FREQUENCY: rf transmission line; consists of RG-55/U cable, with P101 one end, P110 other end; 6 in. lg overall; including terminations; CADV #90973-1	Connects rf input to turret attenuator
W102	++	CABLE ASSEMBLY, RADIO FREQUENCY: rf transmission line; consists of RG-55/U cable, with P105 one end, P106 other end; 18 in. lg overall, including terminals; CADV #90973-2	Connects coaxial switch to impulse noise generator
W103	++	CABLE ASSEMBLY, RADIO FREQUENCY: rf transmission line; consists of RG-55/U cable, with P102 one end, P107 other end; 17 in. lg overall, including terminations; CADV #91035-1	Connects Z115 to S101
XI101	+	LAMPHOLDER: bayonet; for indicator light; CSE-708; CADV #10785	Holds dial light
XI102	+	SOCKET ASSEMBLY, NEON INDICATOR LAMP: one-inch clear plastic lens; stovepipe type; inside matted; for NE-48 neon lamp; overall length 2-7/16 in., max dia 1-3/8 in.; 1 in.-27 thread; with nut and lockwasher for mtg; requires one-inch mtg hole; two solder lug terminals rear of unit; CAYZ-80206-947; CADV #10488	Socket assembly for I102
XV101	**	SOCKET, ELECTRON TUBE: subminiature; 8 pins; round base; p/o Z108; CMG #46A17647; CADV #10629	Socket for V101
XV102		Same as XV101	Tube socket for V102
XV103		Same as XV101 (p/o Z109)	Socket for V103
XV104		Same as XV101 (p/o Z109)	Socket for V104
XV105		Same as XV101 (p/o Z110)	Socket for V105
XV106	2Z8677.99 N16-S-62603-6700 —	SOCKET, ELECTRON TUBE: JAN SO10C; 7 contacts; miniature; one piece saddle mtg; sub-chassis; two 1/8 in. dia mtg holes on 7/8 in. mtg/C; 5/8 in. dia chassis cutout required; round ceramic body 1-3/32 in. lg by 13/16 in. dia; phosphor bronze cad plated contacts; no markings; steel shield 3/32 in. dia; spec JAN-S-28; CEB #7676; CADV #10118	Socket for V106

++ Assemble from component parts
+ Low failure item - if required requisition from ESO referencing NAVSHIPS 900, 180A
** If failure occurs, requisition a replacement part from ESO, referencing NAVSHIPS 900, 180A as authority

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
XV107		Same as XV106	Socket for V107
XV108		Same as XV106	Socket for V108
XV109		Same as XV106	Socket for V109
XV110		Same as XV106	Socket for V110
XV111		Same as XV106	Socket for V111
XV112		Same as XV106	Socket for V112
XV113		Same as XV106	Socket for V113
XV114		Same as XV106	Socket for V114
XV115		Same as XV106	Socket for V115
XV116	2Z8679.38 N16-S-64063-6714 —	SOCKET, ELECTRON TUBE: 9 pin miniature; JAN type #TSE9T102; one piece saddle mtg, sub-chassis; two 1/8 in. dia mtg holes on 1-1/8 in. mtg/c; 3/4 in. dia chassis cutout required; round ceramic body; 1-3/16 in. by 15/16 in. dia overall; beryllium-copper silver plated contacts; spec JAN-S-28A; CMG #53F13381; CADV #10036	Socket for V116
XV117		Same as XV106	Socket for V117
XV118		Not used	
XV119		Same as XV106	Socket for V119
XV120		Same as XV106	Socket for V120
XV121		Same as XV116	Socket for V121
XV122		Same as XV106	Socket for V122
Y101	— N16-C-97733-4201 —	CRYSTAL UNIT, QUARTZ: 15 megacycles; fundamental type; CR-7 type holder; spec MS-91378; two radial wire leads; mfg by Cryco, Inc.; CADV #10690	BFO crystal oscillator
Z101	+	CHOKE, RADIO FREQUENCY: 15 mc; self resonant; consists of 200 mmf ceramic capacitor wound with approximately 15 turns of #25 enameled copper wire; CADV #90839-1	Filament filter, V106
Z102		Same as Z101	Filament filter, V107
Z103		Same as Z101	Filament filter, V108
Z104		Same as Z101	Filament filter, V109
Z105		Same as Z101	Filament filter, V110-V111
Z106	— N16-F-34464-5778 —	CHOKE, RADIO FREQUENCY: 15 mc; self-resonant; consists of 22 mmf ceramic capacitor wound with approximately 53 turns #34 enameled copper wire; CADV #90947-1	BFO plate filter, V112

+ Low failure item - if required requisition from ESO referencing NAVSHIPS 900, 180A

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
Z107	– N16-G-59001-1031 –	CALIBRATOR, IMPULSE NOISE: 8 to 20 cycles-per second; frequency range 0 to 4000 megacycles; one band (broad band) output voltage flat per unit bandwidth to approx 4000 mc; used with multi-vibrator trigger type oscillator; noise pulse output 0.00009 microseconds; output impedance 50 ohms; includes 39.6 ohm and 10 ohm film-type resistors and 1500 mmf feed-thru capacitor; overall length 3 in.; round body portion 1-5/8 in. dia by 1-1/2 in. lg; mounting plate 1-3/4 in. square mtd 3/4 in. from one end; four #22 holes, one at ea corner, in mtg plate for screw mtg; type "N" coaxial connector one end extending 9/16 in. from round body portion; 3/8-32 NEF threaded portion extends 9/16 in. from opposite end; two 3/8-32 locknuts; terminates in feedthru capacitor; CADV #90857-1	Impulse noise calibrator
Z108	– N16-T-20551-1066 –	SUBASSEMBLY: includes mounting plate, tube sockets XV101, XV102, printed circuits, R101, R102, R103, R104, R105, R106, R107, R109, C110, C111, C112, C113, C114, C127, L101; CADV #90847-1	RF stage
Z109	– N16-T-20551-1067 –	SUBASSEMBLY: includes mounting plate, printed circuits, tube sockets XV103, XV104 and R111, R112, R113, R114, R125, C138, C139, C140, C141, C146, C147, C148, C176, L102, T150; CADV #90848-1	Mixer stage
Z110	– N16-T-20551-1068 –	SUBASSEMBLY: includes mounting plate, printed circuits, tube sockets XV105, R115, R124, C159, C160, C174, C175, L103; CADV #90849-1	Oscillator stage
Z111	– N16-T-20551-1070 –	SUBASSEMBLY: includes printed link circuit and two contact clips on ea end; CADV #90992-1	RF-mixer coupling link
Z112	– N16-T-20551-1069 –	SUBASSEMBLY: antenna circuit; includes RG-58A/U cable, P102, printed circuit, mtg plate and coil contact clips; CADV #90894-1	Antenna input
Z113		ATTENUATOR, RADIO FREQUENCY: consists of attenuator pads E136, E137, E138, E139, E140 and E141, connector J102 and switch S101 and miscellaneous structural components; CADV #90802-1 (LISTED FOR REFERENCE ONLY)	RF attenuator
Z114	– N16-C-19142-3386 –	ISOLATING CAPACITOR ASSEMBLY: frequency range 20 to 400 mc; 50 ohms impedance; consists of series-connected tubular ceramic capacitor 15,000 mmf, 1000 vdc peak; brass body, satin chrome plated; has 1 in. square by 1/4 in. mtg flange 21/32 in. from one end for panel mtg; overall dim. 3 in. lg by 5/8 in. dia exclusive of mtg flange; has special 50 ohm type "N" female connector ea end; end nearest mtg flange used as J101 RF INPUT receptacle; CADV #90785-1	RF input isolating capacitor and rf input connector
Z115	– N16-F-044794-5539 –	FILTER, LOW PASS: 470 mc design cut-off frequency; 50 ohms input and output impedance; two UG-625/U connectors one at input and one at output ends; overall dim. 10-1/2 in. lg by 2-1/4 in. w by 7/8 in. h; cased; brass, silver plated; mounts by three screws; CADV #91033-1	Attenuates signals above cut-off frequency
Z200	– – –	NETWORK, IMPEDANCE MATCHING: consists of two 150 ohm and one 36 ohm 1/2 watt carbon resistors; enclosed in metal shield; 5/16 in. h by 1/2 in. lg by 1/2 in. w; CADV #90672-1	Input impedance matching network

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
Z201	— / N17-T-82210-3238 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T101, C101, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90841-1	Antenna coil, band 1
Z202	— / N17-T-82213-9726 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T102, C102, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks; trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90842-1	Antenna coil, band 2
Z203	— / N17-T-82220-3426 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T103, C103, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90843-1	Antenna coil, band 3
Z204	— / N17-T-82225-5875 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T104, C104, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90844-1	Antenna coil, band 4
Z205	— / N17-T-82235-4151 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T105, C105, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90845-1	Antenna coil, band 5
Z206	— / N16-T-82238-4276 / —	TRANSFORMER, RADIO FREQUENCY: antenna stage; consists of T106, C106, antenna coil printed circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90846-1	Antenna coil, band 6
Z207 thru Z210		Not used	
Z211	— / N17-T-82210-3244 / —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T111, C121, rf stage plate circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor and adjusting slug and miscellaneous hardware; CADV #90851-1	RF stage plate circuit coil, band 1
Z212	— / N17-T-82213-9732 / —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T112, C122, rf stage plate circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90852-1	RF stage plate circuit coil, band 2
Z213	— / N17-T-82220-3432 / —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T113, C123, rf stage plate circuit eyelet assembly, right and left-hand coil mounting blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90853-1	RF stage plate circuit coil, band 3

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
Z214	— N17-T-82225-5881 —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T114, C124, rf stage plate circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90854-1	RF stage plate circuit coil; band 4
Z215	— N17-T-82235-4157 —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T115, C125, R116, rf stage plate circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90855-1	RF stage plate circuit coil, band 5
Z216	2Z9646.150 N17-T-82238-4286 —	TRANSFORMER, RADIO FREQUENCY: rf stage plate circuit; consists of T116, C126, R117, rf stage plate circuit eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90856-1	RF stage plate circuit coil, band 6
Z217 thru Z220		Not used	
Z221	— N17-T-82210-3294 —	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T121, C131, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting slug and miscellaneous hardware; CADV #90861-1	Mixer stage grid coil, band 1
Z222	— N17-T-82214-1576 —	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T122, C132, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90862-1	Mizer stage grid coil, band 2
Z223	— N17-T-82220-4126 —	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T123, C133, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90863-1	Mixer stage grid coil, band 3
Z224	— N17-T-82225-6731 —	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T124, C134, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90864-1	Mixer stage grid coil, band 4
Z225	2Z9646.138 N17-T-82235-5158 —	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T125, C135, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90865-1	Mixer stage grid coil, band 5
Z226	— N17-T-82238-4876	TRANSFORMER, RADIO FREQUENCY: grid circuit, mixer stage; consists of T126, C136, grid circuit mixer stage eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90866-1	Mixer stage grid coil, band 6
Z227 thru Z230		Not used	

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
RADIO INTERFERENCE-FIELD INTENSITY METER IM-88/URM-47 (Cont'd)			
Z231	— N17-T-82210-3254 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T131, C151, C161, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90871-1	Oscillator coil, band 1
Z232	— N17-T-82213-9778 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T132, C152, C162, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90872-1	Oscillator coil, band 2
Z233	— N17-T-82220-3445 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T133, C153, C163, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90873-1	Oscillator coil, band 3
Z234	— N17-T-82225-5898 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T134, C154, C164, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90874-1	Oscillator coil, band 4
Z235	— N17-T-82235-4179 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T135, C155, C165, R118, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90875-1	Oscillator coil, band 5
Z236	— N17-T-82238-6851 —	TRANSFORMER, RADIO FREQUENCY: oscillator stage; consists of T136, C156, C166, R119, oscillator eyelet assembly, right and left-hand coil mtg blocks, trimmer capacitor adjusting screw, coil inductance adjusting slug and miscellaneous hardware; CADV #90876-1	Oscillator coil, band 6
		POWER SUPPLY PP-906/URM-47	
301-399	— F16-P-66911-3476 —	POWER SUPPLY: Army-Navy type PP-906/URM-47; supplies 225 volts dc at 150 ma, -60 volts dc at 10 ma and 6.3 volts at 6 amperes; regulated; operates on 105 to 125 and 210 to 250 volts, 50 to 1000 c.p.s. alternating current; power consumption 175 watts; p/o RI-FI Meter AN/URM-47; CADV #90783-1	Power supply
C301		Not used	
C302	— N16-C-20167-9825 —	CAPACITOR, FIXED, ELECTROLYTIC: spec JAN-C-62; 90 mfd + 20%, - 10%; 400 vdcw; 4-1/4 in. lg by 1-3/8 in. dia; CSF #V7242; CADV #10382	B+ filter capacitor
C303	3DB1-377 N16-C-48817-2793 —	CAPACITOR, FIXED, PAPER DIELECTRIC: single section; spec JAN-C-62; 1.0 mfd ± 10% temperature characteristic - 55°C; 600 vdcw; hermetically sealed rectangular metal can; mounting bracket and terminals on bottom; 2-3/4 in. by 41/64 in. by 2-7/16 in.; two solder lug terminals, both insulated from case; JAN CP69B1DF105K; CD #CP69B1DF105K; CADV #10499	B+ filter capacitor

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		POWER SUPPLY PP-906/URM-47 (Cont'd)	
C304	3DB4-390 N16-C-49981-9980 —	CAPACITOR, FIXED, PAPER DIELECTRIC: 4 mfd + 20%, - 10%; 600 vdcw; hermetically sealed metal case; 4-1/2 in. lg by 1-1/2 in. dia; Dykanol G impregnated and filled; no internal ground connections; single hole mtg; spec JAN-C-5; CD #CP40C2FF405X; CADV #10169	B+ filter capacitor
C305	— — —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: disc type; 20,000 mmf; 600 vdcw; tolerance GMV; 9/16 in. dia; 0.156 in. thk; green; marked "CR" and "0.02"; two radial wire leads 1-3/4 in. lg; CBN #DD-203; CADV #10493; same as C118	Grid coupling for V305
C306	— — —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: disc type; 20,000 mmf; 600 vdcw; tolerance GMV; 9/16 in. dia; 0.156 in. thk; green; marked "CR" and "0.02"; two radial wire leads 1-3/4 in. lg; CBN #DD-203; CADV #10493; same as C118	Screen bypass, V305
C307	— — —	CAPACITOR, FIXED, CERAMIC DIELECTRIC: disc type; 20,000 mmf; 600 vdcw; tolerance GMV; 9/16 in. dia; 0.156 in. thk; green; marked "CR" and "0.02"; two radial wire leads 1-3/4 in. lg; CBN #DD-203; CADV #10493; same as C118	Filter for V304
C308		Same as C302	C supply filter capacitor
CR301	2Z7521-7 N17-R-51401-8461 —	RECTIFIER, METALLIC: selenium; single phase full wave circuit; input 130 v ac; output 0.065 amp max dc current; square shape; overall dim. 11/16 in. square by 9/16 in. thk; mts by 6-32 screw; two terminals, solder lug type, located perpendicular to axis at ea extremity; complete rectifier composed of four rectifier stacks; CAFQ 8J1; CADV #10819	C supply rectifier
CR302		Same as CR301	C supply rectifier
CR303		Same as CR301	C supply rectifier
E301		Not used	
E302	2Z1619-50 N17-C-945002-0652 —	CAP AND CHAIN, RECEPTACLE: for Navy type -49435 receptacle; aluminum, sandblasted finish; round; 1-9/16 in. max dia by 5/8 in. max thk; chain 3-1/8 in. lg; CPH #9760-22; CADV #10157	Cap and chain for J303
E303	— N16-S-34557-8351 —	SHIELD, TUBE: brass nickel plated; tubular; open top; bayonet type mtg; 0.810 in. ID by 0.941 OD by 1-3/4 in. lg; internal tension spring for retaining tube in socket; JAN-S-28A; JAN TS102U02; CER SOS-6; CADV #10116; same as E106	Shield for V303
E304	— N16-S-34607-8353 —	SHIELD, TUBE: brass nickel plated; 2-1/4 in. lg by 0.810 in. ID by 0.941 OD; internal tension spring for retaining tube in socket; tubular open top; bayonet type mtg; for 7-pin miniature socket; JAN S-28A spec; JAN TS102U03; CADV #10039; same as E110	Shield for V304
E305	— N16-S-34557-8351 —	SHIELD, TUBE: brass nickel plated; tubular; open top; bayonet type mtg; 0.810 in. ID by 0.941 OD by 1-3/4 in. lg; internal tension spring for retaining tube in socket; JAN-S-28A; JAN TS102U02; CER SOS-6; CADV #10116; same as E106	Shield for V305

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		POWER SUPPLY PP-906/URM-47 (Cont'd)	
E306	3Z737-53 N17-P-69140-9300 —	POST, BINDING: push type; 15/16 in. lg by 1/2 in. dia overall; no stud; 0.1640 in. dia hole by 3/16 in. dia 8-32 thread; brass, nickel plated; 1/8 in. by 5/32 in. wire hole; adjustable; max opening 5/32 in.; locating hole; CEB #6604; CADV #10171	Ground connection
F301	3Z2603.2 GM17-F-16302-0120 —	FUSE, CARTRIDGE: 3 amps at 250 v; normal blowing time MIL-F-15160A spec #FO2G3R00A; one time; glass body; ferrule; 1-1/4 in. lg by 1/4 in. dia type 3AG; CLF #312003; CADV #10800	AC line fuse
F302		Same as F301	AC line fuse
F303		Same as F301	Spare fuse
F304		Same as F301	Spare fuse
H301A	2Z2642.170 N16-C-300798-866	CLAMP, ELECTRICAL: for electron tube; 1-3/8 in. ID by 1-1/2 in. OD by 3/4 in. lg; accom. 1-3/8 in. dia tube base; mtg brkt with slotted hole for #10 MS on 29/32 radius snap buckle action with tension loop; stainless steel; CAIS 926C; CADV #10271	Clamp for R301
H301B		Same as H301A	Clamp for V301
H302	— N16-C-300799-0482 —	CLAMP, ELECTRICAL: for electron tube; type 302 stainless steel; 1-3/8 in. ID by 3/4 in. lg; accommodates 1-3/4 in. tube base; mtg bracket with slotted hole for #10 machine screw on 29/32 radius; snap buckle action with tension loop; CAIS #926H4; CADV #10698	Clamp for V302
H303	— N17-G-153987-882 —	GASKET, CONNECTOR: shoulder cover; neoprene; 5 holes; square; 1-3/16 in. by 1-3/16 in. by 1/32 in. thk; CADV #20063; same as H128	Power receptacle gasket
H304	2Z4868.1158 N17-G-157638-972	GASKET, PANEL: rectangular; one hole; 5-3/4 in. wd by 10-1/16 in. lg by 1/32 in. thk; CADV #20054	Power supply panel
H305	* 	GASKET, FUSE: neoprene; 0.675 in. OD by 0.468 in. ID by 1/16 in. thk; CADV #20312-4	Fuse holder
H306		Same as H305	Fuse holder
H307		Same as H305	Fuse holder
H308		Same as H305	Fuse holder
H309	2Z8085-1.34 N17-S-150263-102 —	SEAL NUT: black silicone "O" ring and sleeve; hex shape; no dimension greater than one inch; CAOR #H1267; CADV #70084	Toggle switch seal
H310	2Z4868.1157 N17-G-154218-301 —	GASKET, CONNECTOR: neoprene; 1-1/4 in. square by 1/32 in. thk; four 1/8 in. dia holes, two 0.062 in. dia holes; CADV #20062	AC outlet
I301	— GM17-L-06297-0000 —	LAMP, INCANDESCENT: Sig C LM-52; Navy type TB-14; 6-8 volts; 0.15 amp; bulb T-3-1/4 clear; 1-3/16 in. lg overall; miniature bayonet base; C2 filament; burn any position; CG #GE-47; CADV #10051; same as I101	Power supply ON indicator

* Shop Manufacture

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		POWER SUPPLY PP-906/URM-47 (Cont'd)	
J301	2Z3065-109 N17-C-73209-3387 —	CONNECTOR, RECEPTACLE: Navy type (-491954); five round female contacts; polarized; straight; 7/8 in. OD by 1-1/4 in. lg cylindrical aluminum body; clear lacquer finish; synthetic rubber insert; four 0.120 in. dia mtg holes; 29/32 in. between mtg/C; 7/8-20 NEF-2 thread; electrostatic shielding between receptacle and mating plug is sphere and cone type; CED 02AR-14S-5S; CADV #10189	Power output receptacle
J302	2Z3023-93 N17-C-73462-1624 —	CONNECTOR, RECEPTACLE: Navy type (-491953); three round male contacts; polarized; straight; 7/8 in. OD by 1-1/4 in. lg less plug prong; cylindrical aluminum body; clear lacquer finish; molded phenolic insert; four 0.120 in. dia mtg holes; 29/32 in. between mtg/C; 7/8-20 in. NEF-2 thread; electrostatic shielding between receptacle and mating plug is sphere and cone type; CED 02AR-14S-7P; CADV #10187	Power input
J303	2Z3083-26 N17-C-73139-7587 —	CONNECTOR, RECEPTACLE: Navy type no. (-49435); two rectangular female contacts; polarized; straight; 1-5/8 in. by 1-5/8 in. by 9/16 in. cylindrical aluminum body, anodized finish; bakelite insert; four 0.120 in. dia mtg holes; 29/32 in. between mtg/C; 1-3/8-18 thread; provided with cap and chain; waterproof receptacle; CPH 974085-9760-22; CADV #10156	Recorder drive connector
R301	— N16-R-85001-1365 —	LAMP, BALLAST: Navy Type TJ422J01; threshold voltage 3 volts; 4.35 amperes current regulation; CBBM type 4350-3.5; CADV #10687	Current limiter
R302	— ***N16-R-49481-126 —	RESISTOR, FIXED, COMPOSITION: JAN RC40BF620J; 62 ohms; ± 5%; 2 watts; spec JAN-R-11; CBZ-HB-6205; CADV #10377-620	Current limiting for V301
R303		Same as R302	Current limiting for V301
R304	— ***N16-R-49427-141 —	RESISTOR, FIXED, COMPOSITION: JAN RC40BF470J; 47 ohms; ± 5%; 2 watts; spec JAN-R-11; CBZ-HB-4705; CADV #10377-470	Current limiting for V301
R305	3RC20BF105J N16-R-50974-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF105J; 1.0 megohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1055; CADV #10011-105; same as R166	Grid decoupling for V305
R306	3RC30BF473J N16-R-50479-0751 —	RESISTOR, FIXED, COMPOSITION: JAN RC30BF473J; 47,000 ohms; ± 5%; 1 watt; spec JAN-R-11; CBZ-GB-4735; CADV #10012-473	Plate dropping, V303
R307	— N16-R-64135-3361 —	RESISTOR, FIXED, WIREWOUND: 4000 ohms; 25 watt ± 5%; 1-1/16 in. lg less terminal lugs; lugs 7/16 in. lg one located axially ea end; die-cast black anodized radiator finned housing 1/2 in. dia, mtg lugs 9/32 in. extended ea side; mts by two #6 screws; Dale Products, Inc. no. RH-25-4000; CADV #10705-402	Bias dropping resistor, V304
R308	3RC20BF105J N16-R-50974-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF105J; 1.0 megohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1055; CADV #10011-105; same as R166	Plate load, V305
R309	3RC20BF824J N16-R-50929-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF824J; 820,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-8245; CADV #10011-824	Voltage divider with REG ADJ

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
		POWER SUPPLY PP-906/URM-47 (Cont'd)	
R310	3Z7480-208 N16-R-88009-4505 —	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms ± 10%; 2 watts; 100°C max continuous oper; 3 solder lug terminals; enclosed molded phenolic case 1-1/16 in. dia by 9/16 in. d; slotted metal shaft 1/4 in. dia by 5/8 in. lg from mtg surface; U taper; insulated contact arm; normal torque; lockbushing 3/8-32 by 1/2 in. lg; non-turn device on 17/32 radius at 9 o'clock; CBZ type J; CADV #10242	REG ADJ control
R311	3RC20BF334J N16-R-50758-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF334J; 330,000 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3345; CADV #10011-334	Voltage divider REG ADJ control
R312	3RC20BF100J N16-R-49237-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF100J; 10 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1005; CADV #10011-100; same as R245	I301 series
R313		Not used	
S301	3Z9847-4.27 N17-S-74049-5902 —	SWITCH, TOGGLE: DPDT; Navy type no. (-24003); 125 v 3 amps; 250 v lamp; body black nickel finish; exposed surfaces bright nickel finish; bat type handle 9/16 in. lg; locking action single hole bushing; 15-32 thread; 15/32 in. lg flush mtd; silver plated contacts; keyway 0.080 in. lg by 0.040 in. dia; CHH 20905; CADV #10172	AC power switch
S302		Same as S301	Line voltage switch
T301	— N17-T-74408-3201 —	TRANSFORMER, STEP UP AND STEP DOWN: two primary windings, five secondary windings; secondary #1, 350 v and 225 v at 165 ma; secondary #2, 12.0 v at 4.7 amps; #3, 6.3 v at 2.5 amps; #4, 6.3 v at 0.45 amps; #5, 5 v at 2 amps; Class A grade 2 transformer; vacuum varnish impregnated (Fosterite process); CBGM #TE-6200; CADV #10689	Power transformer
V301	2J5R4GY N16-T-55446 —	ELECTRON TUBE: JAN type 5R4WGB; CADV #5R4WGB	B+ rectifier
V302	2J6080 N16-T-76080 —	ELECTRON TUBE: JAN type 6080WA; CADV #6080WA	Voltage regulator
V303	2J5651 N16-T-75651 —	ELECTRON TUBE: JAN type 5651; CADV #5651	Voltage regulator
V304	2JOB2 N16-T-52001-5 —	ELECTRON TUBE: JAN type OB2WA; CADV #OB2WA	Voltage regulator
V305	— N16-T-56203-53 —	ELECTRON TUBE: JAN type 6AU6WA; CADV #6AU6WA; same as V113	Voltage regulator
XF301	3Z3282-42.14 N17-F-74266-9219 —	FUSE HOLDER: bayonet type extractor; for 1/4 in. dia by 1-1/4 in. lg #3AG fuse; molded bakelite with brass inserts; 250 v at 1-1/2 amps; 2-9/32 in. lg by 5/8 in. dia overall; 1/2 in. dia threaded body for panel hole mtg; two solder lug terminals on one end; one on side; modified CLF-3410-01; CADV #10331	Fuse holder for F301

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		POWER SUPPLY PP-906/URM-47 (Cont'd)	
XF302		Same as XF301	Fuse holder for F302
XF303		Same as XF301	Spare fuse holder
XF304		Same as XF301	Spare fuse holder
XI301	2Z5991-236 N17-L-76854-3964 —	LIGHT, INDICATOR: with lens; 1/2 in. dia red diamond-cut lens; for miniature bayonet base; CAYS-40; CADV #10115	Power supply on-off indicator
XR301	2Z8670.33 N16-S-63552-3815 —	SOCKET, ELECTRON TUBE: Navy type (-49374A); 8 contact octal; CPH 77MIP-8TM; CADV #10197	Socket for R301
XV301		Same as XR301	Socket for V301
XV302		Same as XR301	Socket for V302
XV303	— N16-S-62603-6700 —	SOCKET, ELECTRON TUBE: JAN SO10C; 7 contacts; miniature; one piece saddle mtg; sub-chassis; two 1/8 in. dia mtg holes on 7/8 in. mtg/C; 5/8 in. dia chassis cutout required; round ceramic body 1-3/32 in. lg by 13/16 in. dia; phosphor bronze cad plated contacts; no markings; steel shield 3/32 in. dia; spec JAN-S-28; CEB #7676; CADV #10118; same as XV106	Socket for V303
XV304	— N16-S-62603-6700 —	SOCKET, ELECTRON TUBE: JAN SO10C; 7 contacts; miniature; one piece saddle mtg; sub-chassis; two 1/8 in. dia mtg holes on 7/8 in. mtg/C; 5/8 in. dia chassis cutout required; round ceramic body 1-3/32 in. lg by 13/16 in. dia; phosphor bronze cad plated contacts; no markings; steel shield 3/32 in. dia; spec JAN-S-28; CEB #7676; CADV #10118; same as XV106	Socket for V304
XV305	— N16-S-62603-6700 —	SOCKET, ELECTRON TUBE: JAN SO10C; 7 contacts; miniature; one piece saddle mtg; sub-chassis; two 1/8 in. dia mtg holes on 7/8 in. mtg/C; 5/8 in. dia chassis cutout required; round ceramic body 1-3/32 in. lg by 13/16 in. dia; phosphor bronze cad plated contacts; no markings; steel shield 3/32 in. dia; spec JAN-S-28; CEB #7676; CADV #10118; same as XV106	Socket for V305
Z301	** N16-S-50973-6251 —	FILTER ASSEMBLY, ELECTRICAL: power supply; consists of four 1500 mmf feedthru capacitors, four 0.01 ceramic disc type capacitors, two coils consisting of 19 turns of #24 Formvar ea, wound on two 10,000 ohm 1 watt resistors; enclosed in aluminum shield can 1-3/4 in. lg by 1 in. w by 25/32 in. thk; two feedthru capacitor terminals ea end extend 7/16 in. beyond case; CADV #90807-1	Power supply input rf filter
		ACCESSORIES	
A401	— N16-T-802001-107 —	TRIPOD: Navy type (-10545) for dipole antenna; collapsible type; 37-1/2 in. lg collapsed; 60 in. extended; wooden legs; aluminum head with aluminum socket for dipole mast; includes wing nut locking devices for legs; reversible legs, spike or rubber feet; CADV #90310-1	Dipole antenna support

** If failure occurs, requisition a replacement part from ESO, referencing NAVSHIPS 900,180A as authority

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps Standard Navy Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
A402	*	MAST SECTION: antenna; Army-Navy Mast Section AB-363/U; one piece construction; straight grain eastern maple; phenolic varnish finished; for tripod mtg; portable; no markings; principal parts consist of mast, connecting tube and rosan; provides support for dipole antenna head assembly; dia at base 27/32 in., dia at top 1 in., height 36-1/8 in., CADV #90920-1	Dipole antenna support
A403		Same as A402	Dipole antenna support
A404		CASE, TEST SET: Army-Navy Case CY-1527/URM-47; carrying case for Radio Interference-Field Intensity Meter IM-88/URM-47; black fibre covered plywood; nickel plated brass corners; rectangular case 23-3/4 in. lg by 11-5/16 in. w by 13-1/4 in. h (with handle down); flock lined interior; carrying type case handle; nameplate marked with appropriate nomenclature and contract number; CADV #90922-1; (LISTED FOR REFERENCE ONLY)	Meter unit carrying case
A405		CASE, ACCESSORIES: Army-Navy Case CY-1525/URM-47; carrying case for Radio Interference-Field Intensity Meter AN/URM-47 accessories; black fibre covered plywood; nickel plated brass corners; rectangular case 15 in. by 13-7/8 in. lg by 10-3/8 in. w (with handle down); flock lined interior; carrying type case handle; nameplate marked with appropriate nomenclature and contract number; CADV #90923-1; (LISTED FOR REFERENCE ONLY)	Accessory case
A406		CASE, ANTENNA: Army-Navy Case CY-1526/URM-47; carrying case for Radio Interference-Field Intensity Meter AN/URM-47 antennas and tripods; black fibre covered plywood; nickel plated brass corners; rectangular case 41-1/4 in. lg by 14-5/16 in. h by 11-3/8 in. w (with handle down); flock lined interior; carrying type case handle; nameplate marked with appropriate nomenclature and contract number; CADV #90924-1; (LISTED FOR REFERENCE ONLY)	Antenna and tripod case
A407	— N16-I-21801-1045 —	INDICATOR, AZIMUTH: used with Army-Navy Antenna Mast Section AB-363/U; aluminum, black lacquer finish; 3 in. lg by 2-1/4 in. dia; 1 in. hole through center; single knurled lock screw; longitudinal leaf tension spring riveted to inner wall; aluminum compass rose screwed to top by two #2-56 screws; compass rose calibrated 360 degrees, numbered at 10-degree intervals; two aluminum sighting pins 1/2 in. lg by 1/8 in. dia at 0 degree and 180 degree positions; CADV #90044-1	Indicator for dipole antenna orientation
A408	— ** —	POINTER, AZIMUTH DIAL: used with Army-Navy Antenna Mast Section AB-363/U; aluminum; caustic dip finish; truncated cone shaped; max dia at base 2 in. tapering to 1-1/4 in. at top; 3/4 in. thk; two 8-32 set screws located 90° apart; center hole 1.093 in. dia first 5/16 in. from bottom, 1.010 in. dia remainder of distance to top; marked with part number and black filled engraved indicator line; CADV #90045-1	Indicates orientation of dipole antenna

* Shop manufacture

** If failure occurs, requisition a replacement part from ESO, referencing NAVSHIPS 900,180A as authority

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
E401	2A2067-371 N16-A-45184-2001 —	ANTENNA ASSEMBLY: Army-Navy Antenna Mast AB-371/U; high frequency; dipole head assembly, less elements; 88 to 400 mcs frequency range; 50 ohms characteristic input impedance; coaxial input; one dipole element may be inserted on ea side of head; tilting type; chrome alloy tubing; satin chrome plated; 35-7/8 in. lg by 7-27/32 in. max w; mts by one-inch dia 20 in. lg grade "A" ash wood mast (included); mounts on tripod A401; has balun slider and J401 connector; CADV #90833-1	High frequency dipole antenna
E402	2A204A-477 N16-A-45176-6001 —	ANTENNA ASSEMBLY: Army-Navy Antenna AT-477/U; low frequency; dipolehead assembly, with elements; 20 to 88 mcs frequency range; 50 ohms characteristic input impedance; coaxial input; one dipole element may be inserted on ea side of head; 14 elements included (NOTE: elements may also be used with E401 (90833-1 Antenna Assembly); tilting type; phenolic and ash wood grade "A"; fungicidal varnish finished; mts by one-inch dia 20 in. lg mast (included); mounts on tripod A401; has two variable inductances for adjusting resonant frequency; CADV #90832-1	Low frequency dipole antenna
E403	2A326-65 N16-B-150221-148 —	ANTENNA BASE: loop; Army-Navy Antenna Base AB-374/URM-47; has BNC connector top end, type N connector 90° away; both connectors located same end; 4-7/8 in. lg by 1-21/32 in. max w; supporting column 0.798 in. dia; aluminum, plain finish; CADV #90995-1	Loop antenna support
E404	2Z308-349 N17-C-67991-2929 —	CONNECTOR, ADAPTER: rf plug; UG-349/U; CARO-2975; CADV #10481	Loop antenna
E405	— N16-A-61910-9362 —	ANTENNA SECTION: whip type, used with AT-477/U; low frequency dipole antenna assembly; chrome alloy steel tubing; satin chrome plate finish; 3 in. w green identification band at center; one end threaded and other end tapped for connecting to adjacent sections; 23-1/2 in. lg by 3/8 in. dia tapering to 1/4 in. dia; CADV #50658	Dipole antenna element section
E406		Same as E405	Dipole antenna element section
E407	— N16-A-61910-9367 —	ANTENNA SECTION: whip type, used with AT-477/U; low frequency dipole antenna assembly; chrome alloy steel tubing; satin chrome plate finish; 3 in. w red identification band at center; one end threaded and other end tapped for connecting to adjacent sections; 23-1/2 in. lg by 25/64 in. dia; CADV #50646	Dipole antenna element section
E408		Same as E407	Dipole antenna element section
E409		Same as E407	Dipole antenna element section
E410		Same as E407	Dipole antenna element section
E411		Same as E407	Dipole antenna element section

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
E412		Same as E407	Dipole antenna element section
E413	— N16-A-61878-5380 —	ANTENNA SECTION: whip type,used with AT-478/U, AT-477/U, and AB-364/U antenna assemblies; chrome alloy steel tubing; satin chrome plate finish; 3 in. w yellow identification band at center; one end threaded and other end tapped for connecting to adjacent sections; 16-1/4 in. lg by 25/64 in. dia; CADV #50659	Dipole antenna element section (used with both high and low head)
E414		Same as E413	Dipole antenna element section
E415	— N16-A-61905-6801 —	ANTENNA SECTION: rod type; used with AT-477/U low frequency dipole antenna assembly, AT-478/U high frequency antenna assembly, and AB-364/U vertical antenna base; chrome alloy, steel and brass, satin chrome plate finish; 3 in. white identification band at center; one end threaded for connecting to adjacent sections; other end telescopic construction; overall dimensions 6-3/8 in. collapsed 20-3/4 in. extended, max dia 11/32 in.; CADV #10724	Dipole antenna element section
E416		Same as E415	Dipole antenna element section
E417	— N16-A-61986-5789 —	ANTENNA SECTION: rod type; used with AT-477/U low frequency dipole antenna assembly, and AB-364/U vertical antenna base; chrome alloy steel and brass, satin chrome plate finish; 3 in. blue identification band at center; one end threaded for connecting to adjacent sections; other end telescopic construction; overall dimensions 23-1/2 in. collapsed, 51-1/2 in. extended, max dia 1/4 in.; CADV #10725	Dipole antenna element section
E418		Same as E417	Dipole antenna element section
E419	— N16-B-150221-152 —	ANTENNA BASE ASSEMBLY: Army-Navy Antenna base AB-364/U; vertical antenna; base plate 13 in. by 14-1/16 in.; max h at antenna mtg post located at center of plate 2-5/8 in.; base plate 52S-H34 1/2 hard aluminum; UG-58/U female connector; 24 round-head 6-32 screws arranged circularly on top surface of base plate for attaching ground plane wires; also used as partition in A405 transit case; CADV #90929-1	Vertical antenna support
E420	— N16-A-45885-4001 —	ANTENNA: Army-Navy antenna AT-426/U; used for radiation measurement; brass, 3/64 in. black rubber dipped coating over silver plating; one turn stranded wire, insulated, for loop winding; 3-1/8 in. OD by 6-7/8 in. lg; has E404; low impedance; CADV #90799-1	Loop antenna
E421	— ***GM17-C-11118-0000 —	CLIP, BATTERY: steel, cadmium plated; jaw spread 3/8 in.; overall dim. 1-1/2 in. lg by 5/16 in. w; CBIT #45; CADV #10436	RF probe cable clip
E422		Same as E421	RF probe cable clip

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
E423	2Z7390-29B N17-C-67729-2081 —	CONNECTOR, RF: UG-29A/U; female both ends (J407 and J408); CARO-UG-29A/U; CADV #10635	Connects 20 ft rf transmission line to rf probe cable
E424	2Z7390-27A N17-C-67444-5085 —	CONNECTOR, ADAPTER, RF: UG-27A/U; right angle adapter; CARO-UG-27A/U; CADV #10661	High frequency dipole antenna right angle adapter
H401	++	TAPE, MEASURING: Army-Navy Measuring Tape TL-635/U; steel; 12 ft lg extended; calibrated in megacycles; tape 3/8 in. w; steel; in steel case, black simulated leather covered; case dim., 3-3/32 in. dia by 9/16 in. thk excluding center portion; center portion (w/crank mechanism) 7/8 in. thk; marked with mfr name and part number; CADV #10611	Dipole measuring tape
H402	2Z2636-4 N17-C-78125-0925	CLAMP, ELECTRICAL: Army-Navy type AN-3057-4; clamp for cable W406; aluminum; clear lacquer finish; 2 fillister head machine screws; 27/32 in. lg by 7/8 in. dia; accommodates cable up to 7/16 in. dia; CED 2255-2; CADV #10046	Cable clamp
HT401	2B955.1 N17-H-52028-9736 —	HEADSET, RADIO: Navy type (-49753); magnetic type; 600 ohms impedance; two receivers 2-1/16 in. dia by 15/16 in. d; one flat metal headband; CTE #TH-37; GFE	Auditory monitor
	— ***N17-H-52025-2091 —	or HEADSET, RADIO: Navy type (-49507-A); magnetic type; 600 ohms impedance; two receivers 2-1/32 in. dia by 3/8 in. d; one flat plastic covered metal headband; CW #D-173329; GFE; alternate headset	
J401	2Z7390-58A N17-C-73108-5906	CONNECTOR, RECEPTACLE: similar to type UG-58/U; special; p/o E401 (LISTED FOR REFERENCE ONLY)	HF dipole antenna receptacle
J402	— N17-C-73108-5905 —	CONNECTOR, RECEPTACLE: type UG-58/U; CADV #10085	LF dipole antenna receptacle
J403		CONNECTOR: female end of E406; type "N"; (LISTED FOR REFERENCE ONLY)	HF dipole antenna right angle adapter female end
J404		RECEPTACLE: loop antenna; cable, connecting end of E404; type "N"; (LISTED FOR REFERENCE ONLY)	E404 cable connector
J405		RECEPTACLE: loop antenna; BNC type; E420 connector (LISTED FOR REFERENCE ONLY)	Loop antenna connector
J406		CONNECTOR, RECEPTACLE: type "N" E403 cable connector (LISTED FOR REFERENCE ONLY)	Loop antenna mount cable connector
J407		CONNECTOR, RECEPTACLE: left end of E405; type "N" (LISTED FOR REFERENCE ONLY)	Cable connector, E405
J408		CONNECTOR, RECEPTACLE: right end of E405; type "N" (LISTED FOR REFERENCE ONLY)	Cable connector, E405
J409		Same as J402	Vertical antenna base connector
J410		Not used	

++ Assemble from component parts

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
J411	2Z3023-89 N17-C-72602-9324 —	CONNECTOR, RECEPTACLE: 3 round male contacts; polarized; straight; 0.656 in. OD by 29/32 in. lg less terminals; cylindrical aluminum body; tin plate finish; melamine insert; 11/16 in. mtg hole; mts by four 0.120 in. dia holes on 23/32 in. mtg/C; Army-Navy type dwg AN-3102-10SL-3P; CED 2054-3; CADV #10042	Remote meter receptacle
L401	— N16-R-89602-4620 —	RESISTOR, VARIABLE, WIREWOUND: (used as variable inductor) one ohm, plus or minus 10%; 2 watts; 40°C max continuous oper; 3 solder lug terminals; enclosed metal case 1-1/8 in. dia by 1-11/32 in. lg; round metal shaft 1/4 in. dia by 3/4 in. lg from mtg surface; linear taper; insulated contact arm; normal torque; bushing 3/8-32 by 1/4 in. lg; non-turn device located on 17/32 radius at 9 o'clock; CMC Series 43, type W, mod; CADV #10249	Dipole antenna series inductance
L402		Same as L401	Dipole antenna series inductance
M401	— F17-M-34601-1294 —	REMOTE METER ASSEMBLY: Army-Navy Meter Voltmeter ME-76/U; DC type; 0-1 ma; fan shaped meter; mtd on royalite plastic case; 45° sloping panel; case gray smooth enamel finish; portable type; 4-5/8 in. w by 4-3/4 in. h by 6-3/8 in. lg overall; accuracy plus or minus 1%; calibrated for non-magnetic panel; black numbers on white background; resistance of meter 1450 ohms plus or minus 10%; 26 scale divisions for 0-100 microvolt scale; 0-40 scale divisions for db scale; long lance-type pointer; self-contained; CADV #90934-1	Remote microvolt and db meter
P401	2Z7390-21D N17-C-70950-7494 —	CONNECTOR, PLUG: Army-Navy Plug UG-21D/U; Navy spec #RE-49F402; 1 male contact; straight type; 3/4 in. OD by 1-3/4 in. lg overall; coaxial; weatherproof; type "N"; CANS #UG-21D/U; CADV #10701	W401 connector
P402		Same as P401	W401 connector
P403	— ***N17-C-70328-1524 —	CONNECTOR, RECEPTACLE: Army-Navy type #AN-3106-14S-7S; 3 round female contacts; polarized; straight; 1-1/8 in. dia by 1-21/32 in. lg overall; cylindrical aluminum body; tin plate finish; melamine insert; mts to cable; 7/8-20 coupling thread; 3/4-20 conduit thread; CED #2075-10; CADV #10094	W403 connector
P404	6Z1736-10 N17-C-71427-2594 —	CONNECTOR, PLUG: Navy type (-491969); 2 flat parallel male blades; straight; 1-3/8 in. lg by 1-1/2 in. dia less contacts; cylindrical phenolic body; mts to cable by means of an integral cable clamp with two 4-40 screws; 0.147 in. dia hole in body for ground wire; CADV #10083	W403 connector
P405	2Z7390-536 N17-C-71414-1801 —	CONNECTOR, PLUG: Army-Navy type UG-536/U; CADV #10478	W402 connector
P406	2Z3025-50 N17-C-71501-9111 —	CONNECTOR, PLUG: Navy type (-491972); 5 round male contacts; polarized; straight type; 1-1/8 in. OD by 1-21/32 in. lg overall; cylindrical aluminum body; silver plate, water dip lacquer; coupling nut 1-1/8 in. OD, 7/8-20 NEF-2 thread; electrostatic shielding between receptacle and mating plug is sphere and cone type; synthetic rubber insert; CED #06AR-14S-5P; CADV #10193	W407 connector

*** For replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
P407	2Z3066-95 N17-C-71211-5560 —	CONNECTOR, RECEPTACLE: Navy type (-491971); 5 round female contacts; polarized; straight type; 1-1/8 in. OD by 1-21/32 in. lg overall; cylindrical aluminum body; silver plate; water dip lacquer finish; coupling nut 1-1/8 in. OD, 7/8-20 NEF-2 thread; electrostatic shielding between receptacle and mating plug is sphere and cone type; synthetic rubber insert; CED #06AR-14S-5S; CADV #10192	W407 connector
P408		CONNECTOR, RF: end of E404 which connects to transmission line; (LISTED FOR REFERENCE ONLY)	Loop antenna cable connector
P409	— N17-C-71408-3425 —	CONNECTOR, PLUG: Navy type plug UG-260/U; Navy spec #RE-49F-380; 1 male contact; straight type; 27/64 in. OD by 31/32 in. lg overall; coaxial; small "N" type constant impedance plug for W304; has bayonet coupling; CARO 3100; CADV #10228	W404 connector
P410	2Z7155 N17-P-61264-5423 —	PLUG, TELEPHONE: JAN type no. PJ-055B; 2 cond; single shank; tubular; black, molded cellulose acetate shell; shank 1/4 in. dia by 1-7/32 in. lg; shell 1/2 in. dia; overall length 2-27/32 in. for lug or eyelet cable termination; CRL PJ-055B; CADV #10089	W405 connector
P411	2Z5598-47 N17-J-39249-3900 —	JACK, TELEPHONE: Navy type (-49929); for 2 conductor plug 0.250 in. dia; 11/16 in. dia by 3-3/8 in. lg overall; contact arrangement J1-1A; mts to cable W303; cable opening 0.250 in. dia; CMA #100A; CADV #10087	W405 connector
P412	2Z7168 ***N17-P-61400-5186 —	PLUG, TELEPHONE: JAN type PJ-068; 3 cond; single shank; tubular black fibre shell; shank 13/64 in. dia by 1-3/32 in. lg; shell 1/2 in. dia; overall length 3-1/4 in. for lug or eyelet cable terminations; CRL-PJ-068B; CADV #10088	W406 connector
P413	2Z3064-143 ***N17-C-70326-9330 —	CONNECTOR, RECEPTACLE: 3 round female contacts; polarized; straight; 7/8 in. dia by 1-1/2 in. lg overall; cylindrical aluminum body, tin plate finish; melamine insert; mts to cable W306; 5/8-24 coupling and conduit thread; Army-Navy type AN-3106-10SL-3S; CED 2072-4; CADV #10069	W406 connector
P414		CONNECTOR, RF: BNC type similar to UG-260/U; not replaceable; (LISTED FOR REFERENCE ONLY)	Loop antenna mounting connector
P415		CONNECTOR, ADAPTER: right angle adapter for high frequency dipole antenna; male end of E406; (LISTED FOR REFERENCE ONLY)	HF dipole antenna right angle adapter male end
R401	3RC20BF390J N16-R-49390-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF390J; 39 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-3905; CADV #10011-390	Resistive balun
R402	3RC20BF100J N16-R-49237-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF100J; 10 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-1005; CADV #10011-100; same as R245	Resistive balun, E402
R403	3RC20BF820J N16-R-49534-431 —	RESISTOR, FIXED, COMPOSITION: JAN RC20BF820J; 82 ohms; ± 5%; 1/2 watt; spec JAN-R-11; CBZ-EB-8205; CADV #10011-820	Resistive balun, E402

*** for replacement

TABLE 8–2. TABLE OF REPLACEABLE PARTS (Cont'd)

Reference Symbol	Stock Numbers: Signal Corps / Standard Navy / Air Force	Name and Description	Locating Function
		ACCESSORIES (Cont'd)	
W401	++	CABLE ASSEMBLY, RADIO FREQUENCY: rf transmission line; Army-Navy rf cable assembly CG-92D/U (20'0"); RG-8/U cable; 20 in. lg including terminations; has P401 one end; P402 other end; CADV #90933-1	RF transmission line
W402	++	CABLE ASSEMBLY, RADIO FREQUENCY: rf probe; RG-55/U cable; two CADV #10436 clips one end, one UG-536/U connector other end; 1 ft 6 in. lg; CADV #90757-1	RF probe cable
W403	3E7350.1-2811 N17-C-48293-9599 —	CABLE ASSEMBLY, POWER ELECTRICAL: Navy type (-62480); JAN TCOP-2 cable; 6 ft lg excluding terminations; has P301 at one end, P302 at other end; CADV #90072-1	AC power cable
W404	3E7350-1.20.16 N16-C-11987-4877 —	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Army-Navy type #CG-573/U (3'0"); 3 ft lg excluding termination; has P409 one end; CADV #90071-1	Oscilloscope cable
W405	3E7350-1.20.15 N16-C-12126-1911 —	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Army-Navy type #CG-572/U (20'0"); RG-108/U cable; 20 ft lg excluding terminations; has P410 one end, P411 other end; CADV #90074-1	Headphone extension cable
W406	3E7350-1.20.13 N16-C-12126-1913 —	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Army-Navy type #CG-571/U (20'0"); RG-108/U cable; 20 ft lg excluding terminations; has P413 and H402 one end, P412 opposite end; CADV #90075-2	Remote meter cable
W407	3E7350-1.3.6 N17-C-48703-5521 —	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Navy type CADV #62481 (10'0"); consists of two #16 conductors and three #22 conductors; black vinyl covering; P303 one end, P304 other end; CADV #90082-1	Power cable assembly

++ Assemble from component parts

TABLE 8–3. MAINTENANCE PARTS KIT

KEY DESIGNATION	QUANTITY
V112	2

TABLE 8–4. CROSS REFERENCE PARTS LIST

JAN DESIGNATION	KEY SYMBOL
CP69B1DF105K	C303
JAN-OA2	V122
JAN-OB2WA	V304
JAN-5R4WGB	V301
JAN-5651	V303
JAN-5718	V105
JAN-5726	V111
JAN-5814	V116
JAN-6AU6WA	V113
JAN-6BH6	V106
JAN-6005	V110
JAN-6080WA	V302
JAN-6135	V112
PJ-055B	P410
PJ-068	P412
RC20BF100J	R245
RC20BF101J	R116
RC20BF102J	R115
RC20BF103J	R120
RC20BF104J	R109
RC20BF105J	R166
RC20BF121J	R178
RC20BF151J	R126
RC20BF152J	R108
RC20BF153J	R192
RC20BF181J	R177
RC20BF183J	R224
RC20BF222J	R107
RC20BF244J	R229
RC20BF271J	R146
RC20BF272J	R106
RC20BF273J	R150
RC20BF274J	R189
RC20BF332J	R129
RC20BF333J	R183
RC20BF334J	R311
RC20BF335J	R222
RC20BF390J	R401
RC20BF392J	R124
RC20BF393J	R101
RC20BF471J	R234
RC20BF473J	R147
RC20BF474J	R196
RC20BF560J	R123
RC20BF561J	R149
RC20BF563J	R125
RC20BF564J	R190
RC20BF565J	R162
RC20BF681J	R226
RC20BF683J	R134
RC20BF684J	R113
RC20BF820J	R403
RC20BF821J	R205
RC20BF822J	R180
RC20BF823J	R184
RC20BF824J	R309
RC30BF124J	R142
RC30BF184J	R127
RC30BF473J	R306
RC40BF220J	R313
RC40BF470J	R304
RC40BF620J	R302
RC40BF823J	R238
S010C	XV106
TSE9T102	XV116
TSF0101	E111
TSF0T105	E116
TS102U02	E106
TS102U03	E110

STANDARD NAVY STOCK NUMBER	KEY SYMBOL
F16-P-66911-3476	301-399
F17-M-23353-7221	100-299
F17-M-34601-1294	M401
G17-E-850271-0101	H138
GM17-C-1118-0000	E421
GM17-F-16302-0120	F301
GM17-L-06297-0000	I301
GM17-L-06811-0025	I101
GM41-W-02445-0002	H135
GM41-W-02446-0002	H136
GM41-W-02449-0002	H137
N16-A-22081-1047	E136
N16-A-45176-6001	E402
N16-A-45184-2001	E401
N16-A-45885-4001	E420
N16-A-61878-5380	E413
N16-A-61905-6801	E415
N16-A-61910-9362	E405
N16-A-61910-9367	E407
N16-A-61986-5789	E417
N16-A-97144-7001	E139
N16-A-97192-1001	E140
N16-A-97197-1001	E141
N16-B-150221-148	E403
N16-B-150221-152	E149
N16-C-11987-4877	W404
N16-C-12126-1911	W405
N16-C-12126-1913	W406
N16-C-15925-5101	C246
N16-C-15978-6110	C140
N16-C-16300-8001	C159
N16-C-16519-8934	C185
N16-C-16549-7001	C151
N16-C-16838-7841	C152
N16-C-17221-3881	C153
N16-C-17670-5861	C154
N16-C-17893-5681	C155
N16-C-17903-6981	C183
N16-C-17919-2388	C281
N16-C-18630-3689	C109
N16-C-18631-1534	C194
N16-C-18787-8062	C115
N16-C-18884-4848	C191
N16-C-19142-3386	Z114
N16-C-19143-3701	C118
N16-C-19458-8421	C264
N16-C-20167-9825	C302
N16-C-29708-5134	C156
N16-C-300798-866	H301A
N16-C-300799-0482	H302
N16-C-44111-3680	C261
N16-C-44281-8250	C259
N16-C-45573-6255	C250
N16-C-45803-1984	C267
N16-C-48817-2793	C303
N16-C-49981-9980	C304
N16-C-62411-8001	C108
N16-C-63927-1376	C181
N16-C-64133-6960	C182
N16-C-69001-1027	L106
N16-C-73088-9362	L104
N16-C-75280-8657	L107
N16-C-97733-4201	Y101
N16-F-044794-5539	Z115
N16-F-34464-5778	Z106
N16-G-433295-0731	O102
N16-G-59001-1031	Z107
N16-I-21801-1045	A407
N16-K-700362-0207	E123
N16-R-49237-431	R245
N16-R-49390-431	R401
N16-R-49247-141	R304
N16-R-49481-126	R302
N16-R-49534-431	R403
N15-R-49579-431	R116
N16-R-49597-431	R178
N16-R-49624-31	R126
N16-R-49642-431	R177
N16-R-49687-431	R146
N16-R-49804-431	R149
N16-R-49840-431	R226
N16-R-49876-431	R205
N16-R-49921-431	R115
N16-R-49966-431	R108
N16-R-50001-431	R107
N16-R-50038-431	R106
N16-R-50065-431	R129
N16-R-50092-431	R124
N16-R-50236-751	R180
N16-R-50281-431	R120
N16-R-50335-431	R192
N16-R-50335-751	R204
N16-R-50353-431	R224
N16-R-50398-431	R150
N16-R-50416-431	R183
N16-R-50443-431	R101
N16-R-50479-0751	R306
N16-R-50479-431	R147
N16-R-50515-431	R125
N16-R-50551-431	R134
N16-R-50587-431	R184
N16-R-50587-939	R238
N16-R-50632-431	R109
N16-R-50650-751	R142
N16-R-50695-751	R127
N16-R-50722-431	R229
N16-R-50740-431	R189
N16-R-50758-431	R311
N16-R-50821-431	R196
N16-R-50857-431	R190
N16-R-50893-431	R113
N16-R-50929-431	R309
N16-R-50974-431	R166
N16-R-51109-0431	R222
N16-R-51208-431	R163
N16-R-55132-0261	R102
N16-R-55213-0121	R103
N16-R-64111-9651	R121
N16-R-64135-3361	R307
N16-R-69155-1034	R138
N16-R-71345-8401	K101
N16-R-85001-1365	R301
N16-R-87351-8010	R233
N16-R-87519-4226	R191
N16-R-87521-8061	R137
N16-R-87679-4180	R128
N16-R-87679-4540	R153
N16-R-87751-8071	R211
N16-R-87849-4248	R182
N16-R-88009-4505	R310
N16-R-89602-4620	L401
N16-S-34520-3862	E111
N16-S-34557-8351	E106
N16-S-34576-6513	E116
N16-S-34607-6039	E110
N16-S-50973-6251	Z301
N16-S-62603-6700	XV106
N16-S-63516-6549	XR301
N16-S-64063-6714	XV116
N16-S-69021-6601	S103
N16-T-20551-1066	Z108
N16-T-20551-1067	Z109
N16-T-20551-1068	Z110
N16-T-20551-1069	Z112
N16-T-20551-1070	Z111
N16-T-25301-1231	E137
N16-T-25471-1014	S101
N16-T-51763	CR101
N16-T-52001	V122
N16-T-52001-5	V304
N16-T-55446	V301
N16-T-56203-53	V113
N16-T-56213-20	V106
N16-T-75651	V303
N16-T-75718	V105
N16-T-75726	V111
N16-T-75814	V116
N16-T-75840	V101
N16-T-76005	V110
N16-T-76080	V302
N16-T-76135	V112
N16-T-802001-107	A401
N16-T-82238-4276	Z206
N17-C-200964-601	E128
N17-C-48293-9599	W403
N17-C-48703-5521	W407
N17-C-67444-2001	J102
N17-C-67444-5085	E424
N17-C-67729-2081	E423
N17-C-67991-2929	E404
N17-C-70326-9330	P413

TABLE 8–4. CROSS REFERENCE PARTS LIST (Cont'd)

STANDARD NAVY STOCK NUMBER	KEY SYMBOL
N17-C-70328-1524	P403
N17-C-70950-7494	P401
N17-C-71211-5560	P407
N17-C-71408-3168	P101
N17-C-71408-5333	P103
N17-C-71414-1801	P405
N17-C-71427-2594	P404
N17-C-71479-5767	J109
N17-C-71501-9111	P406
N17-C-72602-9324	J411
N17-C-73108-1267	J105
N17-C-73108-5905	J402
N17-C-73108-5906	J401
N17-C-73108-7477	J114
N17-C-73184-9201	P109
N17-C-73209-3387	J301
N17-C-73333-7541	P104
N17-C-73462-1624	J302
N17-C-73501-3590	J106
N17-C-73630-9045	J103
N17-C-78125-0925	H402
N17-C-945002-0652	E302
N17-F-74266-9219	XF301
N17-G-153812-881	H127
N17-G-153893-186	H126
N17-G-153987-882	H128
N17-G-154218-301	H310
N17-G-157638-972	H304
N17-G-945001-850	H110
N17-H-52025-2091	HT401
N17-J-39248-4418	J108
N17-J-39249-3900	P411
N17-J-39449-4770	J110
N17-L-76854-3964	XI301
N17-M-29352-9643	M101
N17-P-61264-5423	P410
N17-P-61400-5186	P412
N17-P-69140-9300	E306
N17-R-51401-8461	CR301
N17-S-150263-102	H309
N17-S-250051-0383	E143
N17-S-250051-0385	E144
N17-S-66623-6711	S102
N17-S-74049-5902	S301
N17-T-65498-4751	T157
N17-T-67401-1056	T151
N17-T-67401-1061	T154
N17-T-67401-1064	T152
N17-T-67401-1069	T155

STANDARD NAVY STOCK NUMBER	KEY SYMBOL
N17-T-67401-1074	T156
N17-T-74408-3201	T301
N17-T-82208-6164	T150
N17-T-82210-3238	Z201
N17-T-82210-3244	Z211
N17-T-82210-3254	Z231
N17-T-82210-3294	Z221
N17-T-82213-9726	Z202
N17-T-82213-9732	Z212
N17-T-82213-9778	Z232
N17-T-82214-1576	Z222
N17-T-82220-3426	Z203
N17-T-82220-3432	Z213
N17-T-82220-3445	Z233
N17-T-82220-4126	Z223
N17-T-82225-5875	Z204
N17-T-82225-5881	Z214
N17-T-82225-5898	Z234
N17-T-82225-6731	Z224
N17-T-82235-4151	Z205
N17-T-82235-4157	Z215
N17-T-82235-4179	Z235
N17-T-82235-5158	Z225
N17-T-82238-4286	Z216
N17-T-82238-4876	Z226
N17-T-82238-6851	Z236
N33-G-12575-0710	H130

SIGNAL CORPS STOCK NO.	KEY SYMBOL
2A204-477	E402
2A2067-371	E401
2A326-65	E403
2B955.1	HT401
2J0A2	V122
2J0B2	V304
2J1N63	CR101
2J5R4GY	V301
2J5651	V303
2J5718	V105
2J5726/6AL5W	V111
2J5814	V116
2J5840	V101
2J6BH6	V106
2J6005/6AQ5W	V110
2J6080	V302
2J6135	V112

SIGNAL CORPS STOCK NO.	KEY SYMBOL
2Z394.164	E139
2Z394.170	E140
2Z394.171	E141
2Z1619-50	E302
2Z2636-4	H402
2Z22642.170	H301A
2Z3023-89	J411
2Z3023-93	J302
2Z3025-50	P406
2Z3025-51	J106
2Z3064-143	P413
2Z3065-109	J301
2Z3066-95	P407
2Z308-349	E404
2Z3083-26	J303
2Z3350-123	E128
2Z3351-449	H110
2Z4868.1157	H310
2Z4868.1158	H304
2Z4868.1160	H127
2Z4868.1161	H126
2Z4868.1162	H128
2Z4872-516	O119
2Z5534	J108
2Z5598-47	P411
2Z5598-54	J110
2Z5889-3	I102
2Z5952	I101
2Z5991.236	XI301
2Z7155	P410
2Z7168	P412
2Z7390-21D	P401
2Z7390-260	P103
2Z7390-27A	E424
2Z7390-29B	E423
2Z7390-290	J107
2Z7390-536	P405
2Z7390-58A	J401
2Z7521-7	CR301
2Z8085-1.34	H309
2Z8304.227	E106
2Z8304.275	E116
2Z8304.57	E111
2Z8670.33	XR301
2Z8677.99	XV106
2Z8679.38	XV116
2Z9632.680	T157
2Z9646.138	Z225
2Z9646.150	Z216
3DA1-438	C109

SIGNAL CORPS STOCK NO.	KEY SYMBOL
3DA50-474	C259
3DB1-377	C303
3DB4-390	C304
3E7350.1-2811	W403
3E7350-1.20.13	W406
3E7350-1.20.15	W405
3E7350-1.20.16	W404
3E7350-1.3.6	W407
3RC20BF100J	R245
3RC20BF101J	R116
3RC20BF102J	R115
3RC20BF103J	R120
3RC20BF104J	R109
3RC20BF105J	R166
3RC20BF121J	R178
3RC20BF151J	R126
3RC20BF152J	R108
3RC20BF153J	R192
3RC20BF181J	R177
3RC20BF183J	R224
3RC20BF222J	R107
3RC20BF244J	R229
3RC20BF271J	R146
3RC20BF272J	R106
3RC20BF272J	R150
3RC20BF274J	R189
3RC20BF332J	R129
3RC20BF333J	R183
3RC20BF334J	R311
3RC20BF335J	R222
3RC20BF390J	R401
3RC20BF392J	R124
3RC20BF393J	R101
3RC20BF473J	R147
3RC20BF474J	R196
3RC20BF561J	R149
3RC20BF563J	R125
3RC20BF564J	R190
3RC20BF565J	R162
3RC20BF681J	R226
3RC20BF683J	R134
3RC20BF684J	R113
3RC20BF820J	R403
3RC20BF821J	R205
3RC20BF823J	R184
3RC20BF824J	R309
3RC30BF124J	R142
3RC30BF153J	R204

SIGNAL CORPS STOCK NO.	SYMBOL KEY
3RC30BF184J	R127
3RC30BF473J	R306
3RC30BF822J	R180
3Z2603.2	F301
3Z3282-42.14	XF301
3Z6610-392	R138
3Z7310-143	R233
3Z737-53	E306
3Z7410-209	R153
3Z9847-4.27	S301
6D10105A	N101
6Z1736-10	P404

ARMY-NAVY TYPE	KEY SYMBOL
AB-363/U	A402
AB-364/U	E419
AB-371/U	E401
AB-374/URM-47	E403
AN-3057-4	H402
AN-3102-10SL-3P	J411
AN-3106-10SL-3S	P413
AN-3106-14S-7S	P403
AT-426/U	E420
AT-477/U	E402
CG-571/U(20'0")	W406
CG-572/U(20'0")	W405
CG-573/U(3'0")	W404
CG-92D/U(20'0")	W401
CW-123/U	E128
CY-1525/URM-47	A405
CY-1526/URM-47	A406
CY-1527/URM-47	A404
IM-88/URM-47	101-299
ME-76/U	M401
PP-906/URM-47	301-399
PT-188/URM-47	N101
TL-635/U	H401
UG-21D/U	P401
UG-27A/U	E424
UG-29A/U	E423
UG-290/U	J107
UG-349/U	E404
UG-536/U	P405
UG-58/U	J402
UG-88/U	P103

TABLE 8–4. CROSS REFERENCE PARTS LIST (Cont'd)

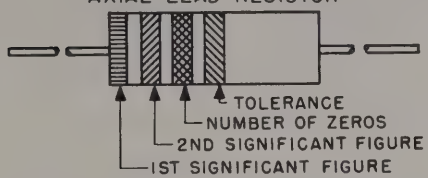
MILITARY STANDARD	KEY SYMBOL	NAVY TYPE	KEY SYMBOL
FO2G300A	F301	-491953	J302
		-491954	J301
		-491957	J110
		-491969	P404
		-491971	P407
		-491972	P406
		-49374A	XR301
		-49435	J303
		-49753	HT401
		-49929	P411
		-62480(6'0")	W403
		-62481(10'0")	W407

NAVY TYPE	KEY SYMBOL
TB-14	I101
VG-12	I102
-10545	A401
-24003	S301
-49025A	J108
-491942	J106

TABLE 8–5. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

COLOR CODE FOR JAN FIXED RESISTORS VALUES IN OHMS

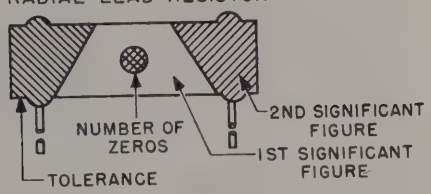
AXIAL LEAD RESISTOR



RESISTOR WITH AXIAL WIRE LEADS

COLOR	1ST BAND	2ND BAND	3RD BAND	END BAND
	VALUE	VALUE	VALUE	TOLERANCE
Black	0	0	None	Gold ±5%
Brown	1	1	0	
Red	2	2	00	
Orange	3	3	000	Silver ±10%
Yellow	4	4	0000	
Green	5	5	00000	
Blue	6	6	000000	None ±20%
Violet	7	7	0000000	
Gray	8	8	00000000	
White	9	9	000000000	

RADIAL LEAD RESISTOR

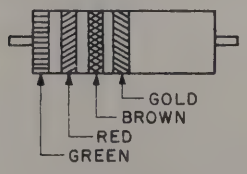


RESISTOR WITH RADIAL WIRE LEADS

COLOR	BODY	END BAND	DOT	END BAND
	VALUE	VALUE	VALUE	TOLERANCE
Black	0	0	None	Gold ±5%
Brown	1	1	0	
Red	2	2	00	
Orange	3	3	000	
Yellow	4	4	0000	Silver ±10%
Green	5	5	00000	
Blue	6	6	000000	
Violet	7	7	0000000	
Gray	8	8	00000000	None
White	9	9	000000000	±20%

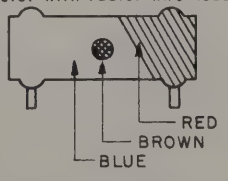
EXAMPLES:

Resistor with axial wire leads



THE RESISTANCE OF THIS RESISTOR IS 520 OHMS ±5%

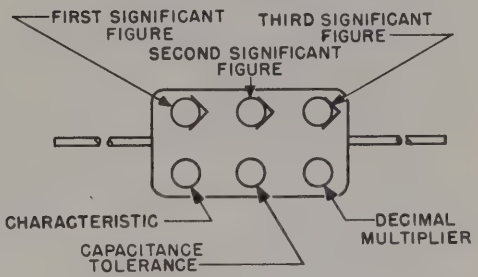
Resistor with radial wire leads



THE RESISTANCE OF THIS RESISTOR IS 620 OHMS ±20%

COLOR CODE FOR JAN FIXED CAPACITORS VALUES IN MMF

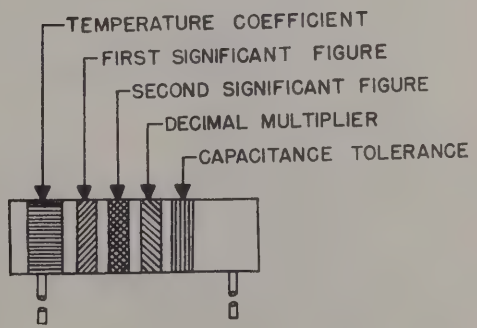
MICA CAPACITOR



MICA CAPACITOR

COLOR	CAPACITANCE		TOLERANCE	CHARACTERISTICS
	SIGNIFICANT FIGURES	DECIMAL MULTIPLIER		
Black	0	1	±20 per cent (M)	A
Brown	1	10		B
Red	2	100	±2 per cent (G)	C
Orange	3	1000		D
Yellow	4			E
Green	5			F
Blue	6			G
Violet	7			
Gray	8			
White	9			
Gold		0.1	±5 per cent (J)	
Silver		0.01	±10 per cent (K)	

CERAMIC CAPACITOR



CERAMIC CAPACITOR

COLOR	CAPACITANCE		TOLERANCE				CHARACTERISTICS *
	SIGNIFICANT FIGURES	DECIMAL MULTIPLIER	CAPACITANCES OF MORE THAN 10 μμf (IN %)		CAPACITANCES OF 10 μμf OR LESS (IN μμf)		
Black	0	1	±20	(M)	2.0	(G)	C–
Brown	1	10	1	(F)			H–
Red	2	100	±2	(G)			L–
Orange	3	1000	—				P–
Yellow	4		—				R–
Green	5		5	(J)	0.5	(D)	S–
Blue	6		—		—		T–
Violet	7		—		—		U–
Gray	8	0.01	—		0.25	(C)	B–
White	9	0.1	10	(K)	1.0	(F)	SL–
Gold							A–

* The significance of these letters will be found in the joint Army–Navy Specification JAN C-5.

TABLE 8–6. LIST OF MANUFACTURERS

PREFIX	NAME	ADDRESS
CADV	Stoddart Aircraft Radio Co., Inc.	6644 Santa Monica Blvd., Hollywood 38, California
CAFQ	Radio Receptor, Inc.	251 W. 19th Street, New York, New York
CAHW	Croname, Inc.	3701 Ravenswood Avenue, Chicago, Illinois
CAIS	The Birtcher Corporation	5087 Huntington Drive, Los Angeles 32, California
CAMD	Good-All Electric Mfg. Co.	Ogallala, Nebraska
CANS	Kings Electronics, Inc.	372 Classon Avenue, Brooklyn 5, New York
CAOR	Radio Frequency Labs.	Boonton, New Jersey
CARO	Industrial Products Co.	Brookfield Street, Danbury, Connecticut
CATD	Fansteel Metallurgical Corp.	Chicago, Illinois
CAUP	Kurz-Kasch, Inc.	1421 South Broadway, Dayton, Ohio
CAUZ	Jeffers Electronics Company	DuBois, Pennsylvania
CAYS	Drake Mfg. Co.	1713 W. Hubbard Street, Chicago, Illinois
CAYT	Allen Mfg. Co.	100 Sheldon Street, Hartford, Connecticut
CAYZ	Dial Light Corp.	900 Broadway, New York, New York
CBBM	Victoreen Instrument Co.	5806 Hough Ave., Cleveland, Ohio
CBGM	Transformer Engineers	389 S. Arroyo Parkway, Pasadena, California
CBIM	Switchcraft Co.	1328-30 N. Halstead Street, Chicago, Illinois
CBIT	Mueller Electric Co.	1597 East 31st Street, Cleveland, Ohio
CBN	Central Radio Laboratory Division of Globe Union	900 E. Keefe Avenue, Milwaukee, Wisconsin
CBYB	Cryco, Inc.	1138 Mission Street, South Pasadena, California
CBZ	Allen-Bradley Co.	118 W. Greenfield Avenue, Milwaukee, Wisconsin
CCO	Carborundum Co. Globar Division	C.P. Knupper Building, Niagara Falls, New York
CD	Cornell-Dubilier Corp.	1000 Hamilton Blvd., South Plainfield, New Jersey
CEB	Hugh H. Eby	4700 Stenton Avenue, Philadelphia, Pennsylvania
CED	Cannon Electric Development Co.	3291 Humboldt Street, Los Angeles 31, California
CER	Erie Resistor Corp.	644 W. 12th Street, Erie, Pennsylvania
CG	General Electric Co.	1 River Road, Schenectady 5, New York
CHC	Hammarlund Mfg. Co.	460 W. 34th Street, New York, New York
CHH	Arrow-Hart & Hegeman Elect. Co.	102 Hawthorne Street, Hartford, Connecticut
CJN	North Electric & Mfg. Co.	South Market Street, Galian, Ohio
CLF	Littelfuse, Inc.	1865 Miner Street, DesPlaines, Illinois
CMA	P.R. Mallory Co., Inc.	1941 Thomas Street, Indianapolis, Indiana
CMC	Clarostat Mfg. Co.	Dover, New Hampshire
CMG	Cinch Mfg. Co.	2339 W. Van Buren Street, Chicago, Illinois
CPH	American Phenolic Corp.	1830 South Fifty-Fourth Avenue, Chicago, Illinois
CR	Wireless Specialty Apparatus Co.	Jamaica Plain, Boston, Massachusetts
CRL	Remler Co., Ltd.	2101 Bryant Street, San Francisco, California
CSE	Signal Electric Co.	1939 Troam St., Menominee, Michigan
CSF	Sprague Electric	North Adams, Massachusetts
CTE	Telephonics Corp.	Park Avenue, Huntington, Long Island
CV	Weston Electrical Instrument Corp.	619 Frelinghuysen Avenue, Newark, New Jersey
CW	Western Electric Company	120 Broadway, New York 5, New York
--	Vitramon, Inc.	Box 544, Bridgeport, Connecticut
Westcap	San Fernando Electric Mfg. Co.	12900 Foothill Blvd., San Fernando, California
--	Winchester Electronics, Inc.	Glenbrook, Connecticut
--	Dale Products Co., Inc.	Box 1, Columbus, Nebraska
--	Pioneer Electronics Corp.	24 Saunders Street, Salem, Massachusetts
DMC	Chicago Die Mold	4001 Wrightwood Ave., Chicago 39, Illinois
--	Precision Crystal Laboratory	2221 Warwick Avenue, Santa Monica, California

INDEX

SUBJECT	FIGURE	TABLE	PAGE
A			
Accessories Case CY-1525/URM-47, description	1–4		1–3
Adjusting the equipment for standard gain			4–18
Adjustment and alignment equipment			7–14
Adjustment and alignment procedures			7–14
Adjustments–			
antenna	3–7, 3–8, 3–9		3–7
Antenna AT-426/U	4–12		4–10
Antenna AT-477/U as a fixed length dipole	4–10		4–9
Antenna AT-477/U as a half wave dipole	4–10		4–9
Antenna Base AB-364/U	4–11		4–11
Dynamic Range control			7–16
FI-10, FI-100, and FI-Buck controls			7–15
initial			3–7
Mast AB-371/U as a half wave dipole	4–9		4–7
Peak Buck control			7–16
QP1 and QP 100 controls			7–15
Alignment–			
i-f			7–15
r-f		7–2	7–16
set-up			7–14
Ammeter ME-76/U, description	1–4		1–4
Antenna–			
AT-426/U, description	1–6		1–5
AT-426/U, use of	4–12		4–11
AT-477/U, description	1–6		1–4
Base AB-364/U, description	1–4		1–4
Base AB-364/U, use of	4–11		4–11
Base AB-374/URM-47, description	1–6		1–6
Case CY-1526/URM-47, description	1–6		1–4
dipole, use of	4–9, 4–10	4–2	4–7
elements, description	1–6		1–4
general theory	2–2		2–2
orientation	3–7, 3–8, 3–9		3–7
Azimuth–			
Dial Assembly, description	1–6		1–6
Pointer Assembly, description	1–6		1–6
B			
Basic principles	1–1		1–1
BFO–			
position of function switch, theory	2–24		2–23
stage, theory	2–15		2–12
C			
Cables, description	1–4		1–4
Calibration chart *(See Chart Set PT-188/URM-47)*			
CAL position of function switch, theory	2–25		2–23
Cases, transit			1–1
Chart Set PT-188/URM-47–			
correcting after alignment			7–19
description	1–2, 4–3 through 4–8		1–3, 4–1
Connection diagram	3–6		

SUBJECT	FIGURE	TABLE	PAGE
Considerations–			
field intensity			4–20
radio interference			4–22
survey			4–20
Controls and receptacles	4–1, 4–2	4–1	4–1
Corrective maintenance			7–1
D			
Data–			
dimensional	3–2 through 3–5	1–1	3–1
rationalizing of interference		4–3, 4–4, 4–5	4–26
recording of observed			4–22
reference			1–6
shipping		1–2	
winding		7–4	
Description (see under item names)			1–1
Detector stage, theory	2–14		2–12
Dimensional data	3–2 through 3–5	1–1	3–1
Dipole mast *(See Mast Section AB-363/U)*			
E			
Electron tube complement		1–3	
Emergency maintenance			5–1
Equipment–			
controls and receptacles	4–1, 4–2	4–1	4–1
initial set-up	3–6		3–2
required for alignment			7–14
set-up for alignment			7–14
supplied		1–1	
External power source connection			3–6
F			
Field intensity–			
considerations			4–20
position of function switch, theory	2–21		2–19
Fourth and fifth i-f amplifier stages, theory	2–13		2–11
Frequency measuring tape *(See Measuring Tape TL-635/U)*			
Function switch, theory	2–20 through 2–25		2–19
Fuse replacement			5–4
G			
General description			1–1
Ground plane vertical antenna *(See Antenna Base AB-364/U)*			
H			
Headphones, Navy Type – 49753	1–2		1–3
High-frequency dipole antenna *(See Mast AB-371/U)*			
I			
I-f–			
alignment			7–15
amplifier and detector stages, theory	2–10 through 2–15		2–10

SUBJECT	FIGURE	TABLE	PAGE
Pulse generator and impulse calibrator stage, theory	2–16		2–12
Initial–			
adjustments			3–7
equipment set-up	3–6		3–2
Input–			
and first i-f amplifier stage, theory	2–11		2–10
filter stage, theory	2–4		2–7
Installation			3–1
Instructions, operating			4–6
Interference survey			4–26
L			
Localization of trouble			7–2
Local oscillator stage, theory	2–7		2–9
Loop antenna			
(See Antenna AT-426/U)			
Low-frequency dipole antenna			
(See Antenna AT-477/U)			
M			
Maintenance–			
corrective			7–1
emergency			5–1
operator's			5–1
preventive			6–1
Major units, description			1–1
Mast AB-371/U, description	1–6		1–4
Mast Section AB-363/U, description	1–6		1–5
Measurement, signal	4–13		4–12
Measuring Tape TL-635/U, description	1–6		1–6
Meter tracking adjustment			7–14, 7–15
Mixer stage, theory	2–8		2–9
O			
Operating–			
instructions			4–6
voltage, tube		7–3	
Operation			4–0
summary of			4–18
Operational tests			7–4
Operator's maintenance			5–1
Optional equipment set-up			3–4
Orienting dipole antenna	3–7, 3–8, 3–9		3–7
Outline dimensions	3–2 through 3–5		
P			
Packing	3–1		3–9
Painting specifications			7–12
Parts lists			8–1
Parts replacement			7–12
Peak–			
operation			4–18
position of function switch, theory	2–23		2–22
Power source, external connection			3–6
Power Supply PP-906/URM-47–			
controls and receptacles	4–2	4–1	
description	1–5		1–4
requirements			3–2

SUBJECT	FIGURE	TABLE	PAGE
Power Supply PP-906/URM-47–(Cont'd)			
theory	2–26		2–23
trouble shooting and repair			7–13
Preliminary checks and adjustments			7–14
Preventive maintenance			6–1
Propagation characteristics for high frequencies			4–21
Pulse amplifier and visual null indicator stages, theory	2–17		2–14
Purpose and basic principles	1–1		1–1
Q			
QUASI PEAK position of function switch, theory	2–22		2–21
R			
Radio Interference-Field Intensity Meter IM-88/URM-47 –			
as a sensitive r-f microvoltmeter			4–20
controls and receptacles	4–1	4–1	
description	1–3		1–3
theory, detailed	2–1 through 2–25		2–6
theory, general			2–2
trouble shooting and repair			7–4
Rationalizing of interference data			4–26
Recording of observed data		4–3	4–22
Reference data			1–6
Remote meter			
(See Ammeter ME-76/U)			
Removal of chassis from case			7–4
Repainting			7–12
Repair and adjustment			7–4
Replacement of–			
fuses			5–4
parts			7–12
tubes	5–1 through 5–4		5–1
R-f–			
alignment set-up			7–16
amplifier stage, theory	2–6		2–9
attenuator and input stages, theory	2–3		2–6
input antennas, theory	2–2		2–2
stages	2–5 through 2–9		2–7
RI-FI Meter			
(See Radio Interference-Field Intensity Meter IM-88/URM-47)			
Right-Angle Adapter UG-27B/U, description	1–6		1–6
S			
Scope of instruction book			1–1
Second and third i-f amplifier stages, theory	2–12		2–11
Selecting site for–			
field intensity measurement			4–20
general interference survey			4–22
Set-up of equipment for–			
alignment and adjustment			7–14
i-f alignment			7–15
meter tracking			7–15
r-f alignment			7–16
Signal measurement			4–12

SUBJECT	FIGURE	TABLE	PAGE
Site selection			
(See Selecting site)			
Standard gain adjustment	.....	.....	4–18
Summary of operation	.....	.....	4–18
Survey considerations	.....	.....	4–20
T			
Tape, frequency			
(See Measuring Tape TL-635/U)			
Test and miscellaneous equipment	.....	7–1	7–14
Test Set Case CY-1527/URM-47, description	1–2	.....	1–3
Tests, operational	.....	.....	7–4
Theory of operation–			
detailed, power supply	2–26	.....	2–23
detailed, RI-FI Meter	2–1 through 2–25	.....	2–6
general	2–1, 2–2	.....	2–2
introduction	.....	.....	2–1
Transit cases	.....	.....	1–1
Transporting the equipment	.....	.....	3–9
Tripod CADV-10545, description	1–6	.....	1–5
Trouble localization	.....	.....	7–2
Trouble shooting–			
chart	7–2	.....	.....
data	.....	.....	7–4, 7–13
Tube–			
change	.....	.....	7–4, 7–13
complement	.....	1–3	.....
location	5–1, 5–2	.....	.....
operating voltage	.....	7–3	.....
replacement	5–1 through 5–4	.....	5–1
U			
Unpacking	3–1	.....	3–1
V			
Video and audio amplifier stages, theory	2–19	.....	2–17
Visual monitoring of signal	.....	.....	4–18
Voltage–			
adjustment, power supply	.....	.....	7–13
check	.....	.....	6–1
regulator stage, theory	2–9	.....	2–10
VTVM and indicating meter stage, theory	2–18	.....	2–17
W			
Winding data	.....	7–4	.....

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